

FOR **ADVANCED DESIGN** IN EARTHMOVING AND  
MATERIAL HANDLING EQUIPMENT--**"HENRY HAS IT!"**

HAMILTON EQUIPMENT CO.  
TEL - 1-711 733 7951

# MARK II BACKHOE

PARTS and INSTRUCTION  
MANUAL



# HENRY®

MANUFACTURING  
COMPANY, INC.  
TOPEKA, KANSAS



**"YOU CAN DO IT BETTER WITH A HENRY"**

913



## WARRANTY

The Henry Manufacturing Co., Inc. warrants each new product to be free from defects in material and workmanship for a period of ninety (90) days from date of delivery to owner.

THIS WARRANTY IS VOID UNLESS THE DELIVERY REPORT OR REGISTRATION CARD IS RETURNED TO THE FACTORY WITHIN 10 DAYS FROM DATE OF PURCHASE. This warranty does not apply to any product that has been altered without the authorization of the manufacturer or has been subjected to misuse and negligence.

The Manufacturer's obligation is limited to the replacement of such parts as shall appear, upon inspection at the factory, to have been defective in material or workmanship. This warranty does not obligate the manufacturer to bear costs of transportation or labor in connection with the replacement or repair of defective parts.

The Henry Manufacturing Co., Inc. reserves the right to make changes in or add improvements to the design or construction of HENRY products at any time without incurring obligation on HENRY products previously sold.



# SECTION I



## INSTALLATION INSTRUCTIONS

### GENERAL INSTRUCTIONS

The Mark II Backhoe was designed for installation with the Henry Model L 600 Loader on most Utility Type Tractors. Mounting Kits are available for many other installations.

These instructions cover typical installations with the Model L 600 Loader and the Model 800 Tractor-Shovel. Installations of the Loader and Tractor-Shovel are covered in separate manuals.

Where the instructions below refer to the right and left side of the Backhoe these directions are determined from the right and left sides of the Tractor.

### PREPARATION OF L 600 LOADER FOR BACKHOE

#### A. INSTALLATION OF "BL-\*" KIT (SEE FIG. 1-1)

1. See separate manual for proper installation of Loader.
2. Attach Backhoe Mounting Bracket to Loader Mainframe.
3. Install Brace Assembly between top of Mounting Bracket and Loader Frame. Brace should be adjusted so that mounting bracket is in vertical position.

\* Different "BL" Kits such as BL-1, BL-2, BL-3, etc., are necessary to fit various makes and models of tractors. See L 600 Loader Installation Book for correct Kit No. to use.



## B. INSTALLATION OF "CH-1" KIT (SEE FIGS 1-3)

1. Disconnect 3/4" Pressure Line from Loader Control Valve at Loader Frame and install selector valve as shown in Fig. 1-3. Reconnect above hose to upper port in selector valve. Install 3/4" hose adaptor union in lower port.
2. Remove pipe plug from pipe tee under Loader Control Valve and install 3/4" hose adaptor union.
3. Install relief valve in pressure line at hydraulic pump. Connect discharge side of relief valve to pump suction line. (See Fig. 1-4).

## PREPARATION OF HENRY TRACTOR-SHOVEL FOR BACKHOE

### A. INSTALLATION OF "BTS-\*" KIT

1. See separate manual for proper installation of Tractor-Shovel.
  2. Attach Backhoe Mounting Kit to Tractor and Tractor-Shovel by following instructions supplied with "BTS" Kit.
- \* Different "BTS" Kits are required for each make & Model of Tractor. They are designated as "BTS- Tractor Model Number".

### B. INSTALLATION OF "CH-2" KIT

1. Bolt selector valve to Tractor-Shovel valve bracket and install relief valve assembly. (See Fig. 1-5).
2. Disconnect pressure line from control valve and connect to relief valve.
3. Install 3/4" x 24" Hose Assembly between inlet port on control valve and forward port on selector valve.
4. Connect discharge side of relief valve to Tractor-Shovel Reservoir. (See Fig. 1-5).

## ASSEMBLE BACKHOE & ATTACH TO TRACTOR

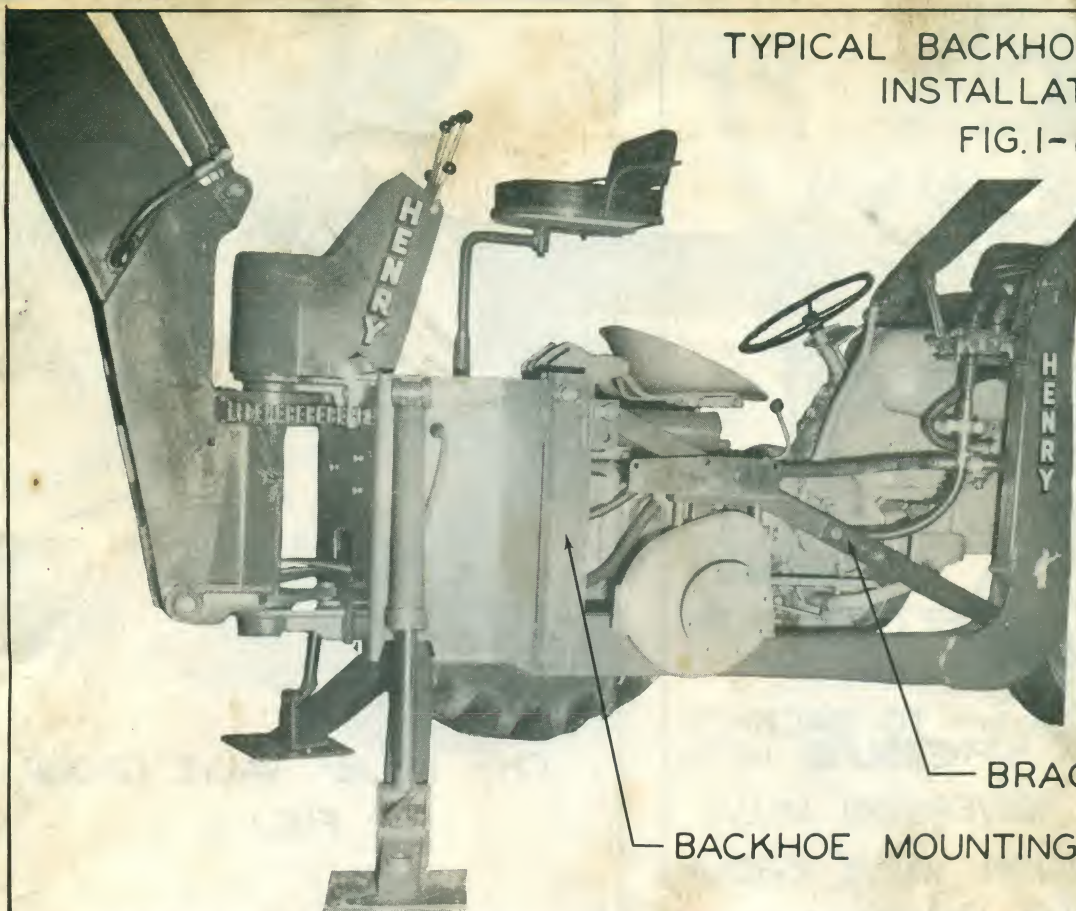
The Mark II Backhoe is shipped with all hydraulic hoses attached to the control valve. The loose ends of all hoses not attached to their cylinders are color coded for your convenience. Be sure to match colors properly when connecting hoses. The Swing Cylinders are removed from the mainframe and packed separately in the Mainframe Crate to reduce size of Crate.

1. To install swing cylinders remove top and bottom trunnion blocks from right side of mainframe frame (3/8" Allen Wrench required). Place right swing cylinder in position and bolt trunnion blocks to mainframe. Pull piston rod out through hole in front of mainframe and check to see if piston rod is within 1/16" of being centered between top and bottom of hole. Place shims under top or bottom trunnions if necessary. Attach swing chain to swing frame with chain anchor block with grease fitting pointing out. Connect 3/8"



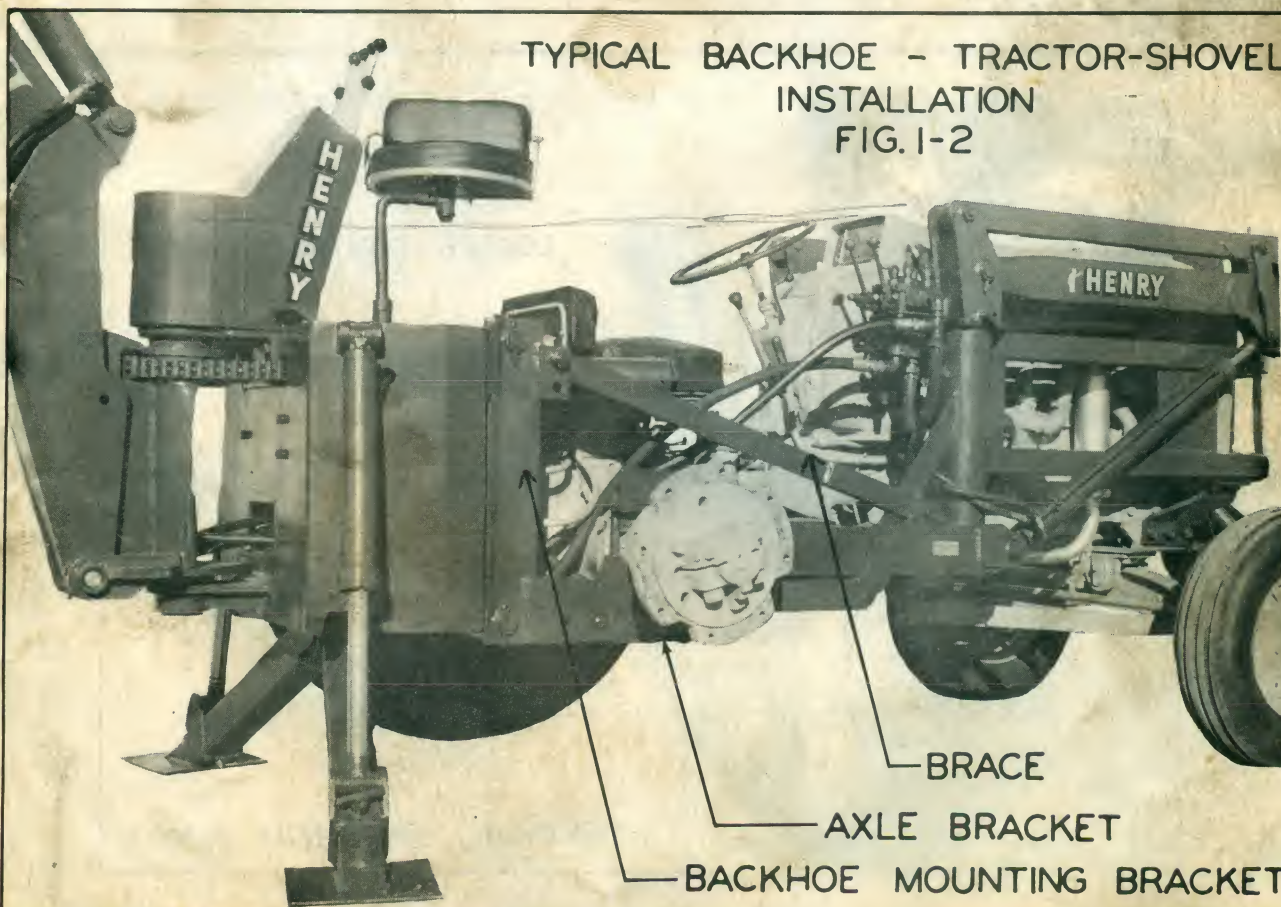
TYPICAL BACKHOE - LOADER  
INSTALLATION

FIG. I-1

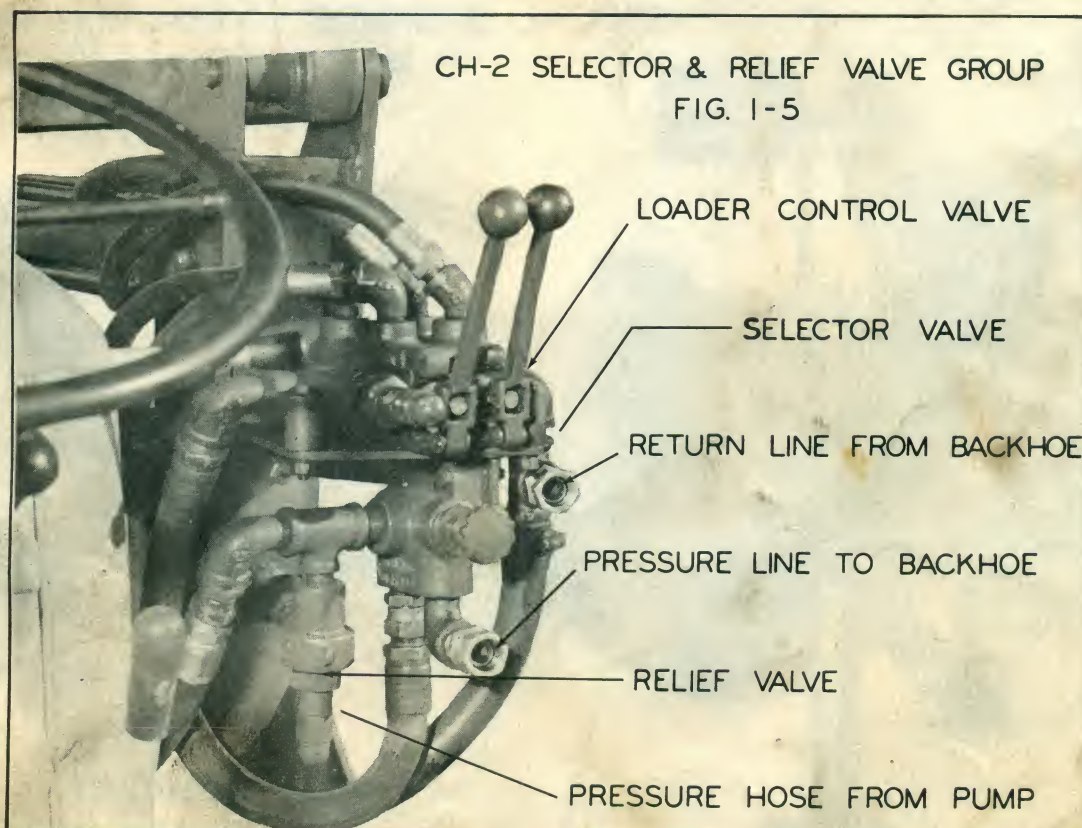


TYPICAL BACKHOE - TRACTOR-SHOVEL  
INSTALLATION

FIG. I-2

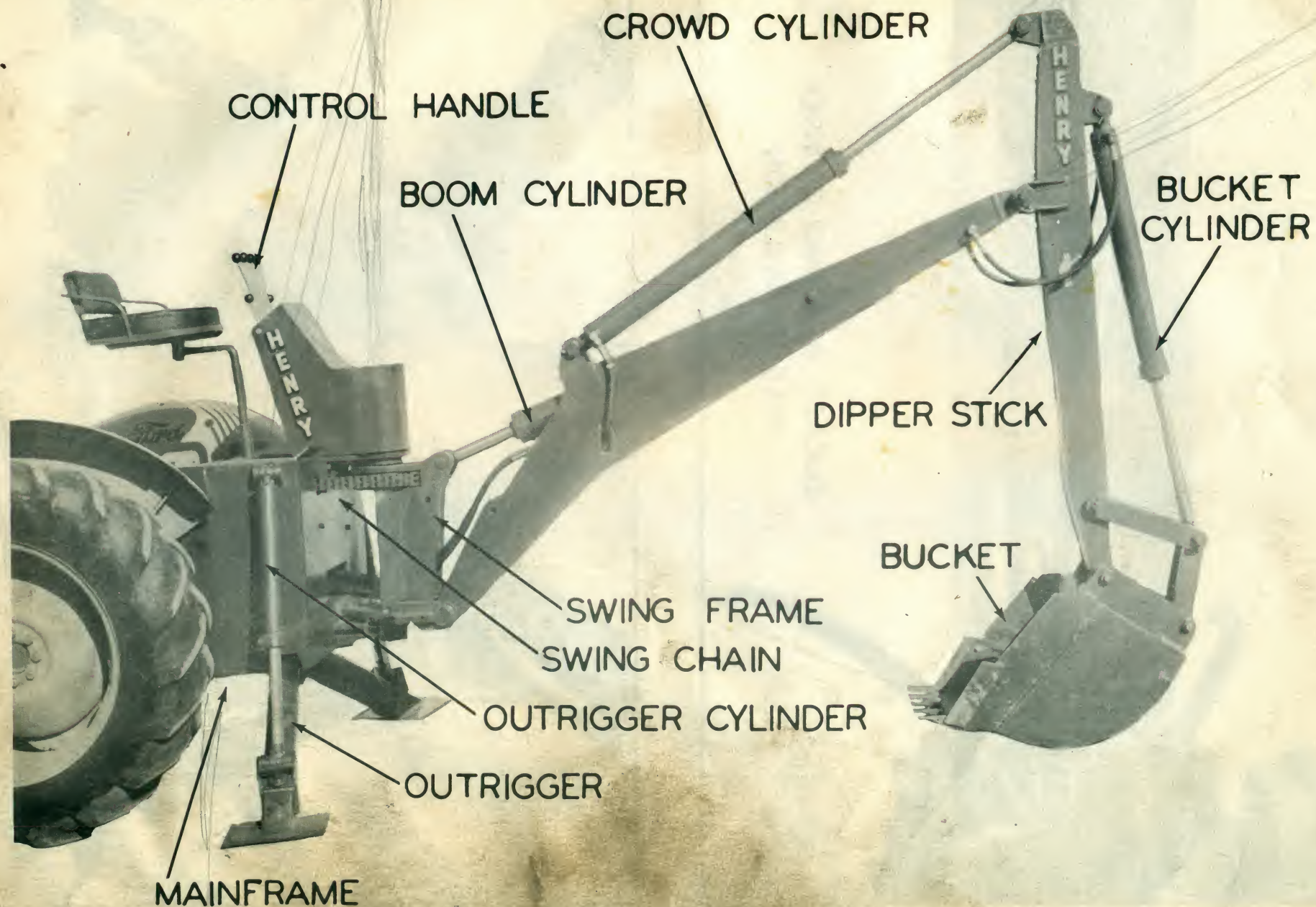




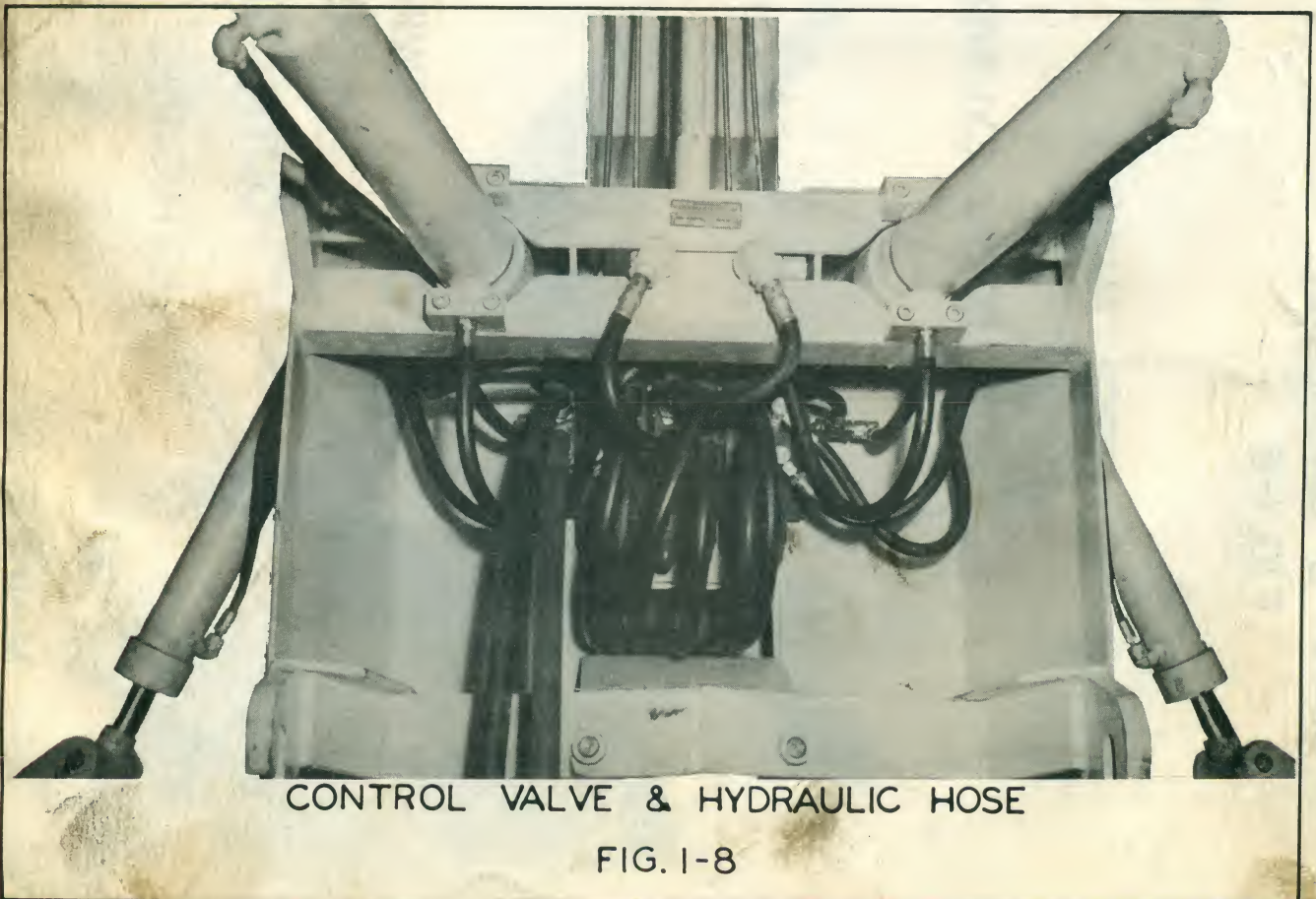
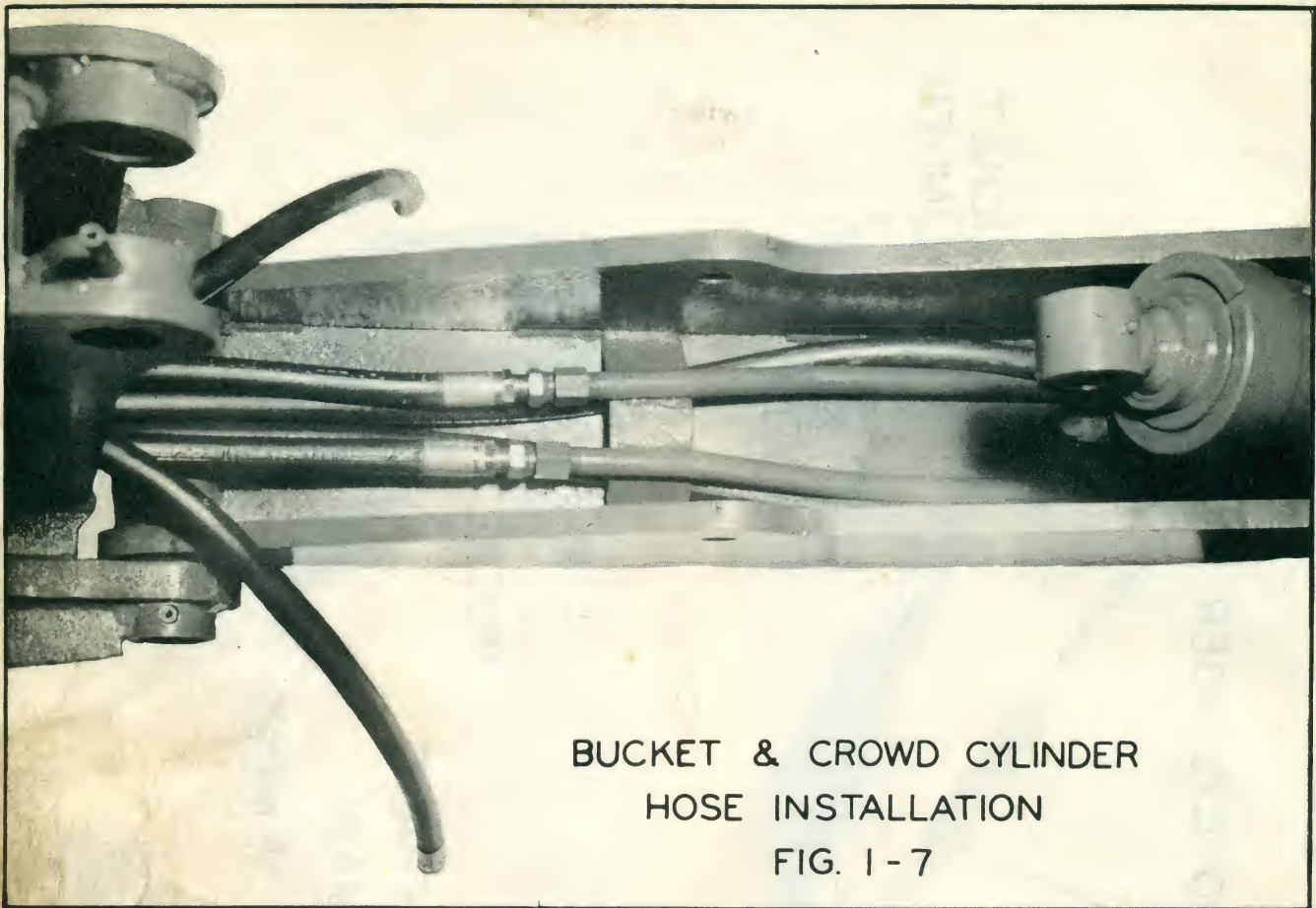




MARK II BACKHOE  
FIG. 1-6









x 24" hose in bottom of swing cylinder trunnion to right port of swing flow regulator. Install 3/8" x 36" hose between return port in forward end of cylinder and return port on right end of control valve.

2. Install left swing cylinders as above and connect to ports on left side of flow regulator and control valve.
3. Remove top mounting pins from the backhoe mounting brackets. Use hoist to set mainframe assembly in position and insert top mounting pins.
4. Connect Backhoe Pressure Hose to selector valve on Loader or Tractor-Shovel. NOTE: THE PRESSURE HOSE IS THE HEAVY OR TWO WIRE BRAID HOSE IN BOTTOM PORT OF BACKHOE CONTROL VALVE.
5. Connect Backhoe return hose to pipe tee in outlet port of Loader control valve.

NOTE: IF BACKHOE IS TO BE REMOVED FROM TRACTOR FREQUENTLY, HYDRAULIC QUICK DISCONNECT COUPLINGS ARE AVAILABLE AS AN ATTACHMENT AND SHOULD BE INSTALLED IN PLACE OF 3/4" HOSE ADAPTOR UNIONS ON PRESSURE AND RETURN HOSE.

6. Attach boom assembly to swing frame and install boom pin locking key (1/2" x 2-1/2" Spirol Pin).
7. Thread crowd cylinder hoses under hose loop inside boom assembly, out under bucket cylinder hydraulic pipe (toward outside of boom), and through holes in side of boom. Attach to crowd cylinder with 1/2"- 90° hose adaptor unions (See Fig. 1-7).
8. Attach bucket cylinder hoses to bucket cylinder hydraulic pipes with matching color codes.
9. Install 1/2" St. Hose Adaptors in boom cylinder ports and attach to hoses with matching color codes.
10. Start tractor and move selector valve to obtain oil flow through backhoe control valve. Operate boom control valve to extend boom cylinder piston rod until it can be attached to pin at top of swing frame.



11. Operate boom control valve to raise boom to full height. ADD ADDITIONAL OIL TO RESERVOIR AS NECESSARY.
12. With Tractor motor running at slow RPM, operate swing control valve carefully to swing boom through full swing arc several times. AFTER ALL AIR IS REMOVED FROM THE SWING CYLINDERS THE SWING CHAINS SHOULD AUTOMATICALLY STAY AT PROPER OPERATING TENSION.
13. Lower boom to convenient height and attach dipper stick assembly.
14. Operate crowd control valve to extend crowd cylinder piston rod. Attach piston rod to pin at top of dipper stick.
15. Install 1/2" - 90° hose adaptor union in hydraulic pipe on boom and install 1/2" x 36" bucket cylinder hoses.
16. Attach outrigger assembly to mainframe and to outrigger cylinders.
17. Attach bucket assembly to dipper stick.
18. Assemble operators seat to seat pedestal rod and adjust to proper position.
19. Start tractor and operate controls several times to remove air from the cylinders. Refill oil reservoir to proper height. IF OPERATION OF ANY CYLINDER IS OPPOSITE OF THAT SHOWN ON INSTRUCTION PLATE IT CAN BE CORRECTED BY REVERSING HOSES AT THE CYLINDER.
20. Lubricate all pivot points.
21. Read Operating Instructions before putting backhoe to work.





## SECTION II

# OPERATION

It is not a difficult task to become an efficient operator of a Henry Backhoe. A special valve operating guide is mounted immediately in front of the valve operating handles to assist you in becoming familiar with the controls. Before attempting to dig a trench, drive the tractor out in an open lot and operate each of the control levers several times. Note that the speed of cylinder operation depends on the amount of control handle travel. This metering action was designed into the control valve to give you precise control of each cylinder. Swing the boom again several times and practice controlling the speed of swing.

Try operating two controls simultaneously, such as raising the boom and extending the crowd cylinder. Note that when both control handles are pulled fully open, only the crowd cylinder will move. Now repeat with the crowd control valve partially opened until both cylinders start to move simultaneously. Practice this dual operation a lot as it will result in much smoother Backhoe operation.



Swing the boom straight behind the tractor and with the dipper stick in a vertical position, push the boom control lever to lower the bucket to the ground. Continue to push the boom control lever and note that sufficient force is available to lift the tractor off the ground. A special adjustable relief valve is located on the boom control valve section immediately in front of the valve spool. Turn the relief valve adjusting handle several turns counter-clockwise and note that you can no longer lift the tractor off the ground. While pushing the boom control handle turn the relief valve adjusting screw clockwise until the tractor starts to raise off the ground. Then back off the adjusting screw one half turn.

With these basic instructions you are now ready to dig. The following suggestions are listed to enable you to learn the digging technique with only a few hours practice.

1. Drive the tractor into digging position. Although the Backhoe boom will swing over  $90^{\circ}$  to either side of center and can be operated anywhere within this arc, digging should be done near the center of swing as practical to provide room for dumping the spoil dirt on either side of the trench.
2. Lower outriggers to raise the tractor wheels approximately 2 inches off the ground and force the outrigger shoes into the ground. Traction angles are furnished with the Backhoe and should be bolted to the outrigger shoes when digging in soft or loose soil. Spear points are available as special equipment for use in hard or frozen ground. On special applications planks or other material can be bolted to the outrigger base for greater flotation.

The outriggers are manually adjustable for width. When lifting and swinging heavy loads to the sides of the tractor they can be extended for greater stability. Since the outriggers are individually controlled the Backhoe can be leveled on slopes up to 25% so that it will dig a vertical trench.

3. OPERATE THE TRACTOR AT APPROXIMATELY 1600 RPM. Lower speeds are recommended until the operator becomes familiar with the machine.
4. When breaking ground to open a new trench, set dipper stick with bucket teeth striking ground approximately two ft. behind vertical position of dipper stick. Without changing position of the boom, bring bucket forward with crowd control. On each succeeding bucket full lower the boom three to six inches and proceed as before. The bucket control should be positioned so that bucket teeth provide a shaving action without the heel of the bucket dragging on the ground.
5. If the bucket becomes stalled, lift the boom slightly and continue. DO NOT HOLD CROWD CONTROL VALVE OPEN WHEN BUCKET STALLS.



6. Rolling the bucket into the ground by pulling the bucket control lever will give extra digging power when needed. It also is used to dig trenches with vertical ends and for loading the dirt in trucks up to 8-1/2 feet high.
7. When the desired depth is reached, raise the outriggers off the ground and move tractor forward. Distance to move depends upon depth of trench. Move forward a greater distance when digging a shallow trench than for a deep one.
8. Moving forward can be done very quickly by pushing the tractor with the bucket against the ground. After a few hours of operation the operator will learn this technique which will permit him to dig a good level bottom trench and move forward without loss of time or motion.
9. When digging near either end of the swing, operator must avoid pulling the bucket into the outriggers. The swing mechanism is equipped with a hydraulic cushioning device for smoother starting and stopping the swing cycle. Mechanical stops are provided at the extreme ends of the swing arc, however, they should be avoided as much as possible since continual bumping can cause serious damage to the swing mechanism.







# SECTION III



## MAINTENANCE AND SERVICE

### PREVENTIVE MAINTENANCE

A good preventive maintenance program will give you continued trouble-free operation.

A suggested preventive maintenance program is outlined below.

#### -DAILY-

1. Lubricate all pivot points with pressure gun grease.
2. Check Hydraulic System for leaks.
3. Check Hydraulic System for proper oil level. Add only recommended oils when necessary.
4. Follow Tractor Operators Manual for daily maintenance checks.

#### -WEEKLY-

1. Check and tighten all mounting bolts and pins.
2. Inspect backhoe bucket. Sharpen or replace bucket teeth and side cutters when needed.
3. Follow Tractor Operators Manual for weekly maintenance.



### -MONTHLY-

1. Clean Hydraulic System filter or screens.
2. Clean Hydraulic System breather cap. Wash in solvent and reoil.
3. Clean oil and dust accumulation off machine.
4. Inspect all hydraulic hoses and fittings. Tighten where necessary to stop leaks. Be sure hoses hang freely to prevent chaffing.
5. Clean swing chains with solvent. DO NOT LUBRICATE.
6. Follow regular tractor maintenance program.

### -ANNUALLY-

1. Disassemble Hydraulic Cylinders for inspection. Replace seals if necessary. Clean and adjust.
2. Disassemble swing frame bearings. Clean, inspect and repack with Multi-Purpose Grease.
3. Inspect swing chains and fittings, replace if worn excessively.
4. Inspect all replaceable bushings. Replace if worn excessively.
5. Check control valve for leaks around spools. Install new seals if necessary.
6. Clean and inspect hydraulic pump and drive assembly for wear. Replace when necessary.
7. Drain Hydraulic System. Clean oil reservoir, filter and plugs. Tighten and readjust all hydraulic fittings.
8. Fill oil reservoir with new oil.
9. Follow regular tractor maintenance program.

### HYDRAULIC OIL

The selection of oil for use as a hydraulic fluid must be made with extreme care to insure satisfactory operation of the hydraulic system. Use only a high quality lubricating oil. Do not use Non-inflammable or Aircraft hydraulic fluid. Most oil companies have lubricating oils or special hydraulic oils that meet the following requirements:

1. Viscosity index of 100 or above.
2. Non-Corrosive.
3. Non-Foaming.
4. Good chemical stability.
5. High film strength.

Detergent oils are satisfactory providing they are non-foaming. Generally speaking a good grade of hydraulic or lubricating oil that meets these viscosity requirements for atmospheric temperature should be used.

Temperature Range below 0° F	---- SAE 5
Temperature Range 0° - 90°	---- SAE 10
Temperature Range above 90°	---- SAE 20 or 30



## TROUBLE SHOOTING HYDRAULIC SYSTEM

Probably the fastest way of locating trouble in the hydraulic system is to use a pressure gauge. The gauge can be attached by adding a pipe tee in the pressure line at the selector valve. The engine should be running at maximum speed used for digging. Operate each control valve until each cylinder reaches the end of its stroke in each direction and note pressure reading in each position. Check pressure while oil is cold then recheck after oil reaches operating temperature. Normal pressure reading should be as follows:

LEFT OUTRIGGER	PULL 1500 to 1550 PSI
	PUSH 1500 to 1550 PSI
CROWD	PULL 1500 to 1550 PSI
	PUSH 1500 to 1550 PSI
BUCKET	PULL 1500 to 1550 PSI
	PUSH 1500 to 1550 PSI
SWING	PULL 1400 to 1500 PSI
	PUSH 1400 to 1500 PSI
BOOM	PULL 1500 to 1550 PSI
	PUSH * to 1150 PSI
RIGHT OUTRIGGER	PULL 1500 to 1550 PSI
	PUSH 1500 to 1550 PSI

\* Boom Down Pressure will vary according to the setting of Boom DOWN pressure control valve.

The hydraulic system will not operate properly if either external or internal leakage is present. External leaks are easily detected and remedied, however, internal leaks are not easily noticed. When internal leaks are present because of leaky valves and piston seals, or worn pump, they can usually be detected by improper operation of the system, overheating of the oil, and will often show up on the pressure gauge.

If the Backhoe is in a raised position and slowly settles to the ground or the boom drifts from side to side, the cylinders should be checked for faulty piston seals. If the movement of each cylinder is slow while under load the pump should be checked for wear. Normal operation while the oil is cold and then gradual slowing down as the oil heats is also an indication of a worn pump. A worn pump may still develop the required pressure but internal leakage in the pump will reduce the volume of oil it delivers to the system until the operation of the backhoe is noticeably slow.



The main relief valve is a safety device to protect the machine from structural damage. It has been adjusted to 1500 PSI at the factory and should not require readjusting. The pressure reading will vary slightly with a change in the volume of oil circulated by the pump. The recommended pump capacity is 15 to 20 GPM and the relief valve has been set with this volume. Pilot operated cartridge type relief valves are used. Since this type of valve is not readily adjustable in the field the complete cartridge should be replaced if adjustment is required. This valve is either located in the inlet section of the control valve or in the pressure line between the pump and selector valve.

The swing cylinder cushioning valves which are located in the SWING flow regulator limit the pressure that can be applied to swing the boom and also act as a cushion in starting and stopping the swing stroke. Increasing the pressure will cause swing to stop too abruptly and may damage the Backhoe. Decreasing the pressure will slow down the swinging speed or even cause it to drift while transporting. The cushioning valves should be set at 1400.

The crowd relief valve limits the amount of pressure that can be locked in the crowd cylinder. This "locked in" pressure is developed by digging with the bucket control while the crowd control is in neutral position. It is also a cartridge type valve and has been factory adjusted to 3000 PSI. This relief valve is located in the crowd control valve section and is marked "3000".

Two special relief valves are included in the boom circuit as shown in Fig. 3-2. The first is manually adjustable and is used to limit the down pressure that can be applied to the bucket. The normal operating pressure will be from 800 to 1100 PSI depending on the weight of the tractor and digging conditions. The second relief valve is a pilot operated cartridge type relief valve set at 2500 PSI and is used to limit the "shock pressure" created when the boom is dropped rapidly and stopped suddenly before it hits the ground.

The hydraulic circuit also includes special orifice plates to control the speed of swing and the speed of boom drop. These orifice plates are found in the cylinder ports on the control valve. They are designed for free flow in one direction and restricted flow in the opposite. The boom orifice plate must be installed in the lower port of the control valve with the "notched" side out. The swing orifices are installed in the cylinder ports of the swing control section with the "notched" side out. (See Fig. 3-1).



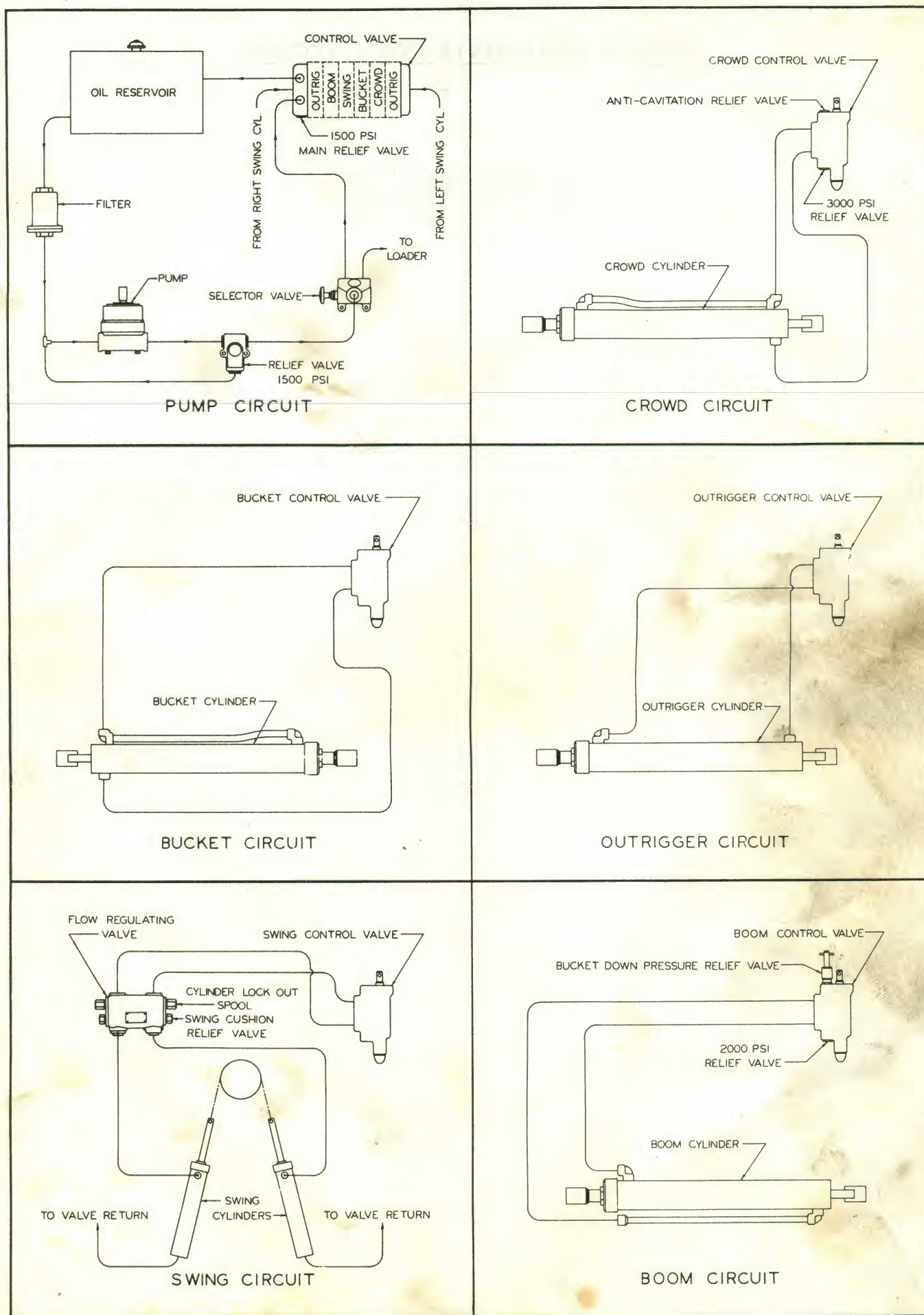


FIG. 3-1, HYDRAULIC CIRCUIT DIAGRAM



SERVICE AND MAINTENANCE RECORD



## TROUBLE SHOOTING CHART

Two basic rules that the Serviceman should consider when checking the hydraulic system are:

1. **THE PUMP DELIVERS A VOLUME OF OIL NOT PRESSURE.** Slow operation indicates a low volume of oil discharged from the pump or that part of oil is lost by leaking seals, valves, etc.
2. **PRESSURE IS CAUSED BY RESTRICTING THE FLOW OF OIL FROM THE PUMP.** This restriction might be caused by a load on the hydraulic cylinder or by relief valve, control valves, etc. Low pressure indicates that the relief valve setting is too low or that oil is going around piston seal or through other components of the hydraulic system.

CAUTION: DO NOT INCREASE PRESSURE ABOVE 1300 PSI

HYDRAULIC SYSTEM WILL  
NOT DEVELOP PRESSURE

Improperly installed.

Check Installation and correct.

Insufficient oil in oil tank.

Fill tank to correct level.

Obstruction in Suction Lines.

Check flow of oil from starting point (at tank) through the system and remove obstruction.

Insufficient relief valve pressure.

Clean screen on end of main relief valve cartridge.

Pump damaged.

Inspect and repair or replace.

Pump Drive failure.

Repair.

CYLINDERS WILL NOT HOLD  
UP LOAD.

Leaking or broken lines leading from control valve to cylinders.

Check for leak. Tighten or replace if broken.

Oil leaking by control valve.

Check valve spool and body for wear. Replace valve section if scored or worn.



## OPERATION TOO SLOW

Piston Packing badly worn or damaged.

Inspect and replace.

Relief valve not working properly.

Check valve adjustment.  
Clean relief valve or install new cartridge.

Insufficient engine speed.

Operate tractor at 1600 to 1800 RPM.

Dirty Filter.

Clean or replace element.

Badly worn Piston Packing.

Replace.

Badly worn pump.

Replace or repair.

## OIL HEATING

Holding control valve handle on raise or lower after hydraulic cylinder has reached end of travel causing oil to by-pass through relief valve too often.

Let control valve handle return to neutral position when not in use. Use correct operational methods.

Using very light oil in hot climates.

Use SAE 10 or 10W below 90°. Use SAE 20 or 30 above 90°.

Dirty oil.

Drain system and refill with new oil.

Insufficient oil in tank.

Fill tank to proper level.

Worn piston packing allowing oil to by-pass piston.

Replace

Badly worn pump.

Replace.



## OIL FOAMING

Air leaking into suction line from tank to pump.

Tighten or replace line.

Water in oil.

Drain and refill with new oil.

Wrong type of oil used.

Use a different brand of oil to get one that resists foaming.

Too much passage of oil through the relief valves.

Correct operational methods.

## OIL LEAKS BY PISTON ROD PACKING OR HYDRAULIC CYLINDERS.

Worn or loose packing.

Replace packing or tighten packing gland.

## HARD WORKING VALVE

Centering spring broken or binding.

Remove valve spring bonnet and adjust or replace spring if broken.

Valve bank studs too tight or uneven.

Loosen elastic stop nuts on return end of valve and retighten to 25 ft. lbs. torque.

Valve spool too tight in housing.

Replace valve section.

## LOW PRESSURE ON CROWD CYLINDER

Crowd relief valve set too low.

Replace.

## CROWD CYLINDER ROD BENDING

Crowd relief valve set too high.

Replace.

## NOISY PUMP

Air leaking into suction line.

Tighten pipe fittings and hose clamps.

Dirty filter.

Clean or replace element.

Low on oil.

Add oil.



BROKEN PUMP HOUSING  
OR SHAFT.

BOOM DRIFTS OR WILL  
NOT SWING.

SWING CHAINS WILL NOT  
STAY TIGHT DURING  
OPERATION

BOOM DROPS TOO  
FAST

Suction hose collapsed.

Oil viscosity too high.

Blocked pressure line.

Defective relief valve.

Relief valve set too high.

Relief valves set too low or  
not seating properly.

Flow regulator not working  
properly.

Badly worn piston rings.

Oriface Plate omitted  
or installed backwards.

Replace hose.

Change to lighter oil or allow  
oil to warm up before operating.

Inspect and remove restriction.

Inspect and repair.

Install new valve cartridge.

Clean and adjust.  
Install safety pin during  
transport.

Regulator spool binding or spring  
broken. Repair or replace.

Replace.

Check for proper  
installation.



## HYDRAULIC CYLINDERS

### MAINTENANCE AND SERVICE

When properly installed and operated the cylinders should require very little servicing other than the occasional replacement of the piston cups or rod packing.

If the cylinder will not hold up a load when the control valve is in neutral or raises slowly, check the piston seal by running the piston all the way to one end of the cylinder and removing the return hose from the cylinder. Hold the control valve open to the opposite or connected end and check for oil flow through the disconnected end. If oil flows out, the piston packing must be replaced. If there is no flow, the cause will be found in some other part of the system.

A seeping packing gland indicates that the packing has worn slightly and should be tightened. Excessive tightening of the packing gland will damage the packing. Tighten only 1/4 turn at a time and check to see if leaking stops. When the cylinder leaves the factory there is approximately 1/8" thread left for adjustment.

Slight scratches on the piston rod surface show dirt or grit wear. Check the wiper ring for abrasive particles lodged under it or for worn or damaged lip. To remove these scratches use a strip of dry medium grit emery cloth and polish with a rotary motion. Do not polish lengthwise. After scratch is removed, use a strip of fine emery cloth dipped in clean oil to polish with a rotary motion for a fine finish.

Deep scratches on rod surface show that either an excessive amount of grit wear or there is a slight mis-alignment on the machine between cylinder end and rod end. The action of a hydraulic cylinder is straight line motion and any mis-alignment must be corrected. If the scratches cannot be removed the rod should be replaced.

#### TO DISASSEMBLE CYLINDER PROCEED AS FOLLOWS:

1. Run piston rod all the way out.
2. Back off packing gland several turns to relieve pressure on packing.
3. Use spanner wrench to unscrew cylinder flange ring.
4. Pull piston rod assembly out of cylinder tube.
5. Place piston rod assembly in bench vise. Vise should grip piston rod bearing only.
6. Remove cotter pin and piston rod nut. Slide piston and cylinder head assemblies off piston rod. Note piston assembly so that it can be reinstalled in same order as removed.
7. Unscrew packing gland and remove packing set.

#### REASSEMBLE CYLINDER AS FOLLOWS:

1. Wash all parts in cleaning solvent or kerosene.



2. Install new packing set in cylinder head by inserting rings one at a time. The "V" rings must be installed so the lips point toward the cylinder. If the packing set is made up of split rings the ends must be staggered around the piston rod.
3. Place the rod wiper over the packing gland with the lip up and press into the recess.
4. Screw packing gland into cylinder head until it just touches packing.
5. Slip cylinder head over piston rod with packing gland toward rod bearing. The piston rod assembly tool (See Fig. 31) should be used to guide cylinder head on piston rod.
6. Place "O" ring in groove on cylinder head.
7. Place new packing set on piston. When double acting packing is used, place male or bottom ring and two "V" rings on bottom piston half. Place male ring and three "V" rings on top piston half, (counterbored for rod nut). Assemble pistons on rod in following order: Two-ring piston, "O" ring, female or center ring, three-ring piston and nut. Tighten nut to 250 ft. lbs. torque.

When single acting packing is used the "V" ring sealing lips must point toward the cylinder head if the cylinder is required to hold a load when pulling (retracting). If the cylinder must hold the load when pushing (extending) the "V" rings should point toward the piston rod nut.

8. Insert piston into cylinder tube with care to prevent damage to packing lip and push cylinder head into cylinder. Squirting oil on cylinder walls before inserting piston will help prevent damage to these seals.
9. Screw cylinder flange ring on cylinder tube.
10. Tighten packing gland until 1/2" of gland extends beyond cylinder head.
11. Install cylinder on machine and operate several times to remove air. Hold control valve open several seconds at each end of the stroke to check for leaks. Tighten packing gland if needed.



## HYDRAULIC CONTROL VALVE

### MAINTENANCE AND SERVICE

OPERATION -- The control valve, whose purpose is to direct the flow of oil from the pump to the cylinders consists of a sliding spool closely fit into a housing which contains a pressure inlet port, two cylinder ports and a return port. The sliding spool has three positions -- IN, NEUTRAL, and OUT. When in the NEUTRAL position oil enters the inlet port, flows through an "open center" passage of the spool to the outlet port. Moving the spool to the IN position closes up the open center passage and simultaneously opens up a passage which directs the flow of oil from the pump to one cylinder port "A". At the same time cylinder port "B" is opened to the return to the reservoir. Moving the spool to the OUT position directs the flow of oil from the pump to cylinder port "B" and opens cylinder port "A" to reservoir.

The control valve actually consists of the six separate valves bolted together as one unit for controlling six separate hydraulic circuits (See Fig. 4-13). These valves are connected in parallel to a common inlet or pressure port. This means that the flow of oil from the pump is available to each valve at all times and that two or more valves can be operated simultaneously.

The control valve also contains a safety relief valve which consists of a spring loaded poppet that closes a port between the pressure and return chambers of the valve. When pressure builds up in the pressure chamber until it exceeds a predetermined load on the spring, the poppet moves off the port allowing oil to bypass the cylinder ports and flow directly to the reservoir.

SERVICE -- The control valve should require very little service other than the occasional replacement of the oil seals unless the spools become worn due to the use of dirty oil. Selective fitting is used at the factory to fit the valve spools in the housings to obtain a very close mechanical clearance. For this reason the valve should be returned to the factory if necessary to replace either the spool or housing. Since some service work can be done in the field the following symptoms and methods of correction are given. (See Fig. 4-13).

#### SYMPTOM: LOSS OR REDUCTION OF SYSTEM PRESSURE AND/OR GALLONAGE.

Remove main relief valve cartridge (21) in inlet section (1) and inspect the screened end of the cartridge for impurities. This screen should be cleaned without disassembly of the relief valve cartridge.

Use a small screw driver or other similar object in one of the four cross holes near the hex of the relief valve cartridge to actuate the pilot body assembly. This pilot body should move approximately 1/8 of an inch toward the screened end of the relief valve cartridge. The pilot body is the round part that can be seen through the four holes nearer the hex of the cartridge. This manual operation will tend to dislodge any particle that could have become wedged between the pilot body assembly and the cartridge body. The seating of the pilot body against the cartridge body can be checked by blowing into one of the four cross holes near the screened end of the relief valve cartridge while covering



the other three holes. If the pilot body assembly is seating you should not be able to blow air through these holes. Relief valves set at 3000 PSI or above cannot be actuated thru the cross holes near the hex but can be actuated thru the other four cross holes. Care must be taken to actuate the pilot body assembly by pushing against its reduced diameter or tapered section so as to not damage the surface that slides against the inside diameter of the cartridge body.

This relief valve is designed for long life, high performance and easy replacement. It should give extremely long life in service with no attention other than an occasional cleaning of the filter screen when used in extremely dirty oil. No repair parts are available for this cartridge. NOTE: The pressure setting of each relief valve is stamped on the outside of the cartridge. When installing new cartridges be sure to use one with same setting as the old one.

#### SYMPTOM: VALVE SPOOLS STICKING

The surfaces of the valve bodies are precision ground for flatness, carefully assembled for cleanliness and the assembly bolts torqued to 20 ft. - lbs. Extreme care should be exercised in protecting the surfaces during service work and to maintain cleanliness of these surfaces when reassembling. Should difficulties arise with the spools sticking it is permissible to reduce the torque on one or more assembly bolts to 12 ft. - lbs.

Dirt or other impurities between the spool and body may also cause the spools to stick. See "External leakage around spools" for instructions for removing and reinserting spools. Spools from different bodies cannot be interchanged.

#### SYMPTOM: EXTERNAL LEAKAGE AROUND LIFT CHECK BODY (14)

External leakage at this point can be caused by damage done to "O" Ring (17) which is located near the outer end of the lift check body. Leakage at this point can pass through the third bolt hole and will at times appear as leakage between sections. It is desirable to check for leakage at the lift check before disassembling the complete valve, if in doubt as to the origin of the leakage.

To check for leakage around the lift checks remove the third assembly bolt and then pry or pull the lift check body from the valve body. Usually damage to this "O" ring can be seen prior to removal of the "O" ring. Since this "O" ring operates at least part of the time at extremely low pressure a relatively small amount of damage to this "O" ring section will cause leakage.

In replacing the lift check body care should be taken that the nylon lift check ball, (15), remains inside the lift check body during installation. A small amount of grease between the lift check ball and lift check body may be used to retain the ball during assembly if necessary. Care should be taken that the lift check body is inserted into the valve body only far enough to permit installation of the assembly bolt. This will alleviate the small possibility of damage to one of the "O" rings around the lift check body.



#### SYMPTOM: EXTERNAL LEAKAGE BETWEEN SECTIONS

There are three "O" rings between each valve section. It is important when assembling the valve stack that the bodies do not move against each other as there is possibility of rolling the "O" rings out of the counter-bores and down into the various valve cavities. The stacks should be assembled starting with the port plate on a flat surface. Then two headless bolts approximately one inch longer than the assembly bolts should be inserted into two of the tapped holes in the port plate. The "O" rings are then placed in the counter-bores in the port plate and the first valve section is guided into the place over the headless bolts. This process is continued until all the valve sections are in place. The assembly bolts are then installed being careful to keep two bolts through the stack at all times to maintain alignment of the bodies. The assembly bolts should be torqued to 20 ft. - lbs.

#### SYMPTOM: EXTERNAL LEAKAGE AROUND SPOOL

The spools may be easily removed by unscrewing the cap assembly Item 7 and then removing the spool and centering spring assembly as a unit from the valve. The "O" ring on the control handle end of the valve can then be examined either with or without removal from the valve body. The "O" ring on the centering spring end of the valve must be removed before reassembly. To remove this "O" ring first remove the body bushing Item 8. The "O" ring is then easily removed and examined. To reassemble the spool place the body bushing and the "O" ring on the spool before assembly into the valve body. Check to see that the spool as replaced protrudes from the valve body an amount approximately equal to the spools in the other valve bodies. This is an indication of whether or not the "O" ring and sleeve assembly are in their proper location.

#### SYMPTOM: CYLINDER LOWERS WHEN VALVE CONTROL HANDLE IS PLACED IN THE "SLOW RAISE" POSITION.

The lift checks are designed to prevent the possibility of a cylinder lowering when the valve handle is placed in the raise position. Failure of this provision to work will be found either in damage to the nylon lift check ball, (15), wear of the seating surface in the lift check body, (14), or damage to the "O" ring section that surrounds the lift check body near the lift check seat.

This inner "O" ring is best examined without disassembly from the valve as it is relatively difficult to install. This "O" ring will continue to function even if a large nick has been caused by assembly and need not be replaced unless it is almost completely destroyed by the action of high pressure operation.

The nylon ball will cease to function if it has been worn considerably out of round or if a great number of impurities have been embedded into its surface. The nylon ball may be replaced without replacing the lift check body but if the lift check body seat shows considerable wear they should both be replaced.



SYMPTOM: LOAD DROPPING WHEN THE VALVE SPOOL IS IN NEUTRAL POSITION.

The valve bodies and spools have been manufactured to extremely close tolerances and precision fitted at the factory. Therefore the valve spool and body are sold only as matched pairs. The clearance between the valve spool and body will gradually increase throughout the service life of the valve. The life of the valve can be increased by maintaining the cleanliness of the hydraulic oil.

Leakage of the relief valve can also be a cause of the boom leaking down. To check for leakage at this point temporarily interchange the anti-cavitation check (28) in the crowd valve section with this relief valve (22). Leakage through the relief valve at pressures considerably below the relief valve setting can be caused by particles becoming wedged between the relief valve pilot body assembly and the seat in the cartridge. This can be checked as noted above.



# SECTION IV



## PARTS LIST

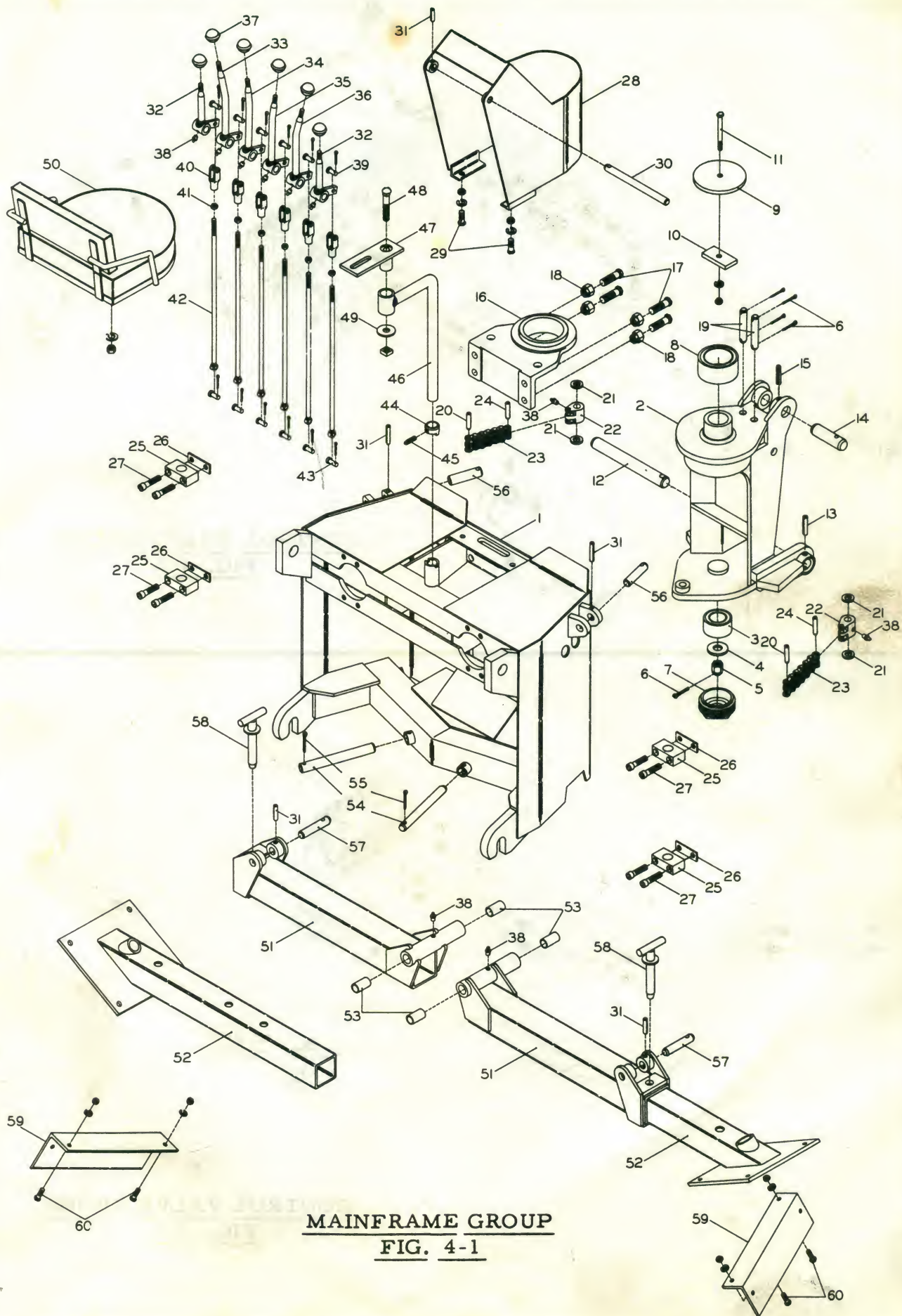
### GENERAL

This Parts List section is set up in the most convenient form for the owner to locate the part and part number when such a need arises. Each part is shown individually in exploded view. When the part is located on the drawing, it is very easy to find the part name and number using the figure number and item number. Instructions for ordering parts are found in the front of this book. BE SURE TO GET THE PART NAME AND PART NUMBER CORRECT BEFORE ORDERING.



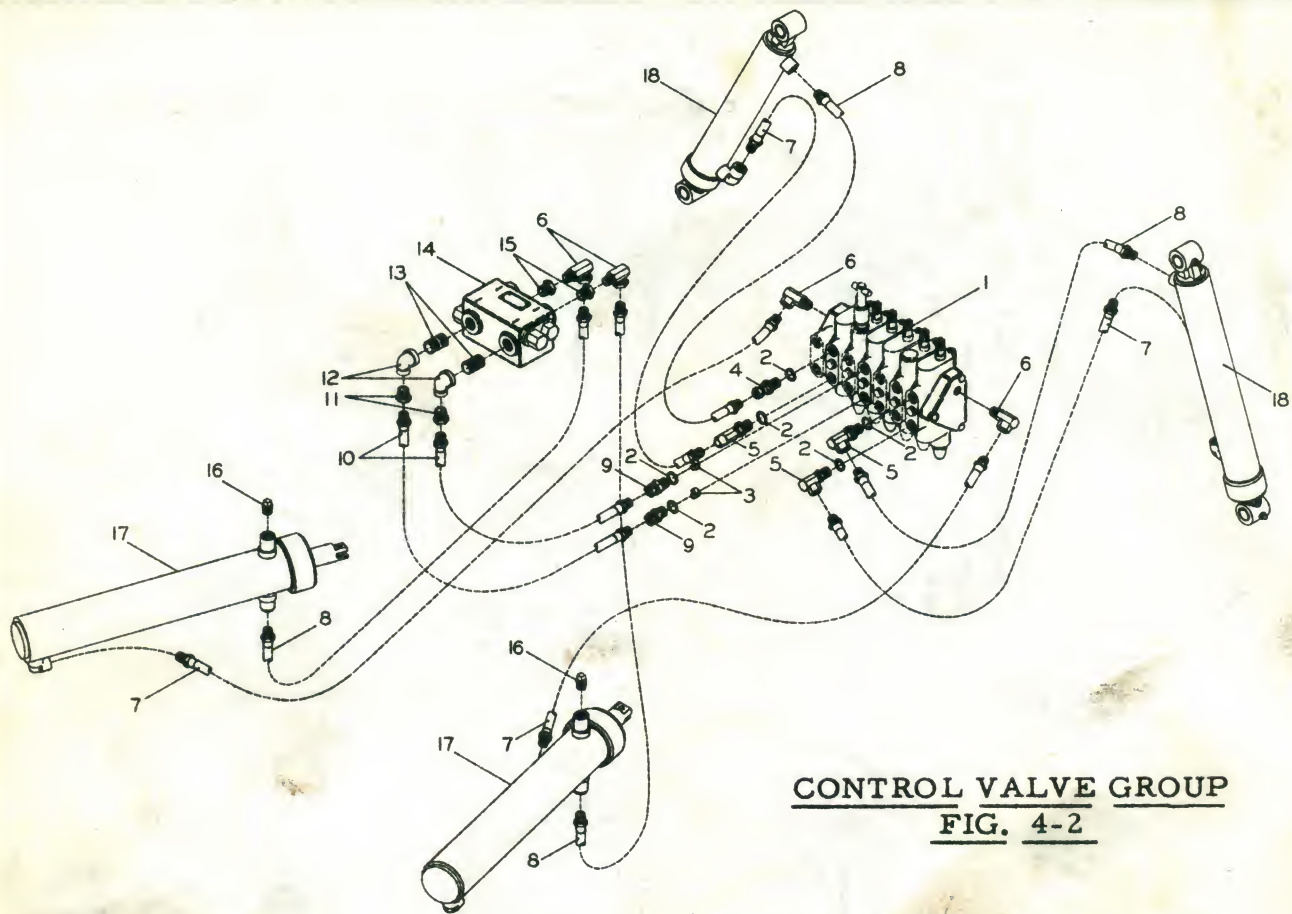
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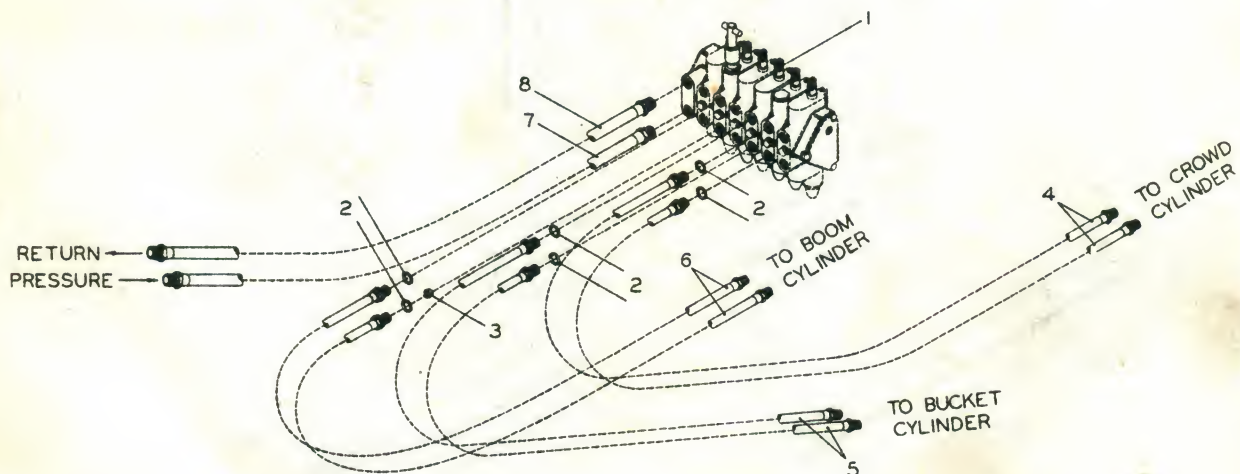


**MAINFRAME GROUP**  
**FIG. 4-1**





CONTROL VALVE GROUP  
FIG. 4-2



CONTROL VALVE GROUP  
FIG. 4-3



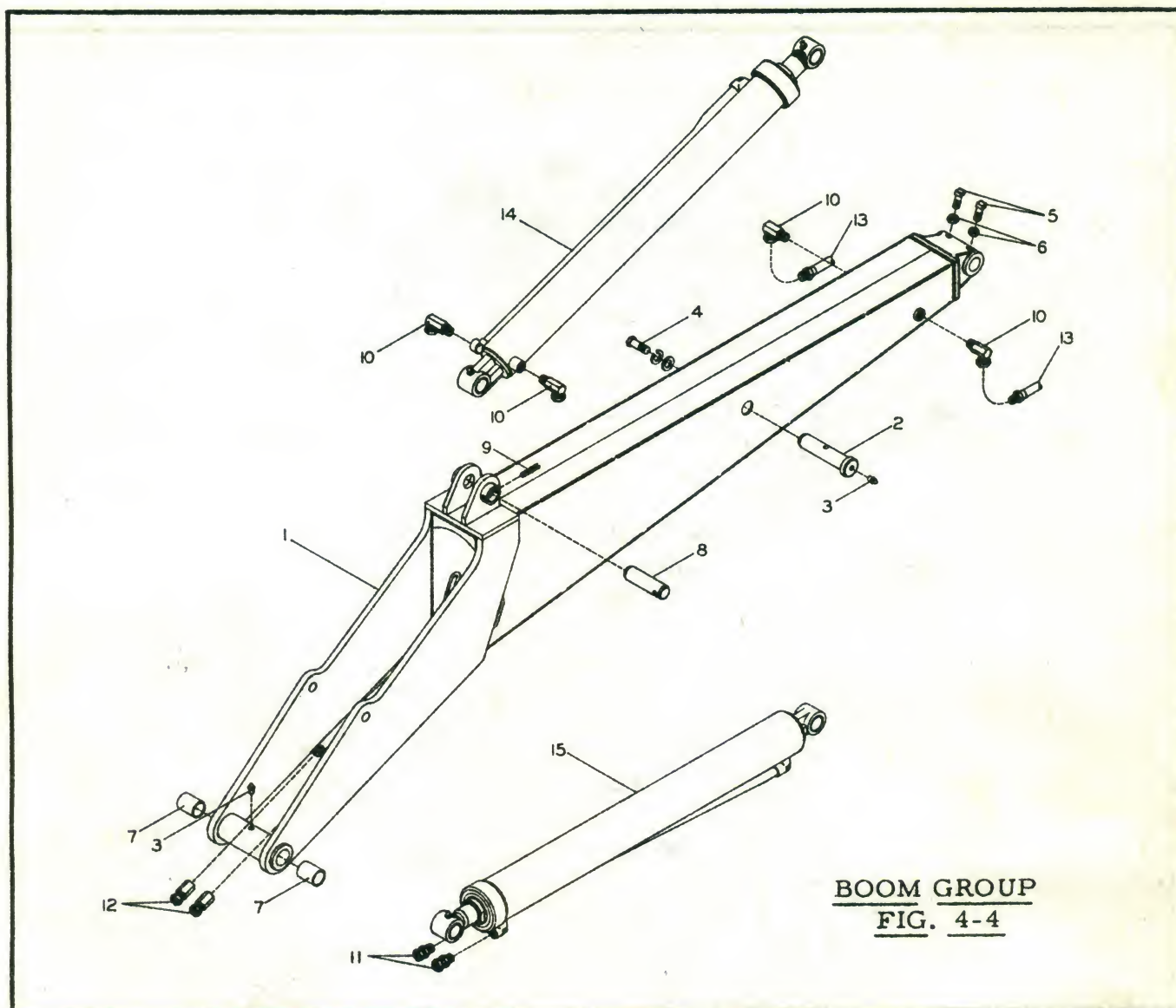
# PARTS LIST

<u>FIG.</u>	<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
4-1	1	E-38-1-2	Mainframe Assembly (Serial No. 7001 & up)	1
4-1	2	E-38-2-2	Swing Frame Assembly	1
4-1	3	A-426	Lower Bearing Assembly	1
4-1	4	G-40-16	1" Flat Washer	1
4-1	5	G-26-16	1" Castle Nut, SAE	1
4-1	6	G-50-3-8	3/16" x 2" Cotter Pin	5
4-1	7	B-38-1-47	Bearing Cap	1
4-1	8	A-425	Upper Bearing Assembly	1
4-1	9	B-38-2-34	Bearing Cover	1
4-1	10	B-38-2-35	Bearing Cover Retainer	1
4-1	11	G-4-8-20	1/2" x 5" USS Cap Screw w/Nut & LW	1
4-1	12	B-38-8-10	Boom Pin	1
4-1	13	A-306-3	1/2" x 2-1/2" Spirol Pin	1
4-1	14	B-36-8-18	Boom Cylinder Pin	1
4-1	15	G-48-6-8	3/8" x 2" Roll Pin	1
4-1	16	E-38-6-1	Upper Pivot Bracket	1
4-1	17	G-5-12-10	3/4" x 2-1/2" SAE Cap Screw	4
4-1	18	G-28-12	3/4" SAE Nut, Self Locking	4
4-1	19	B-38-8-12	Pin, Swing Chain	2
4-1	20	B-38-6-6	Rivet, Swing Chain	2
4-1	21	B-38-2-36	Spacer, Chain Anchor	4
4-1	22	B-38-6-5	Chain Anchor	2
4-1	23	B-38-6-7	Swing Chain	2
4-1	24	B-38-8-13	Rivet, Chain Anchor	2
4-1	25	B-38-7-23	Trunnion Bearing Block	4
4-1	26	B-38-7-26	Shim, Trunnion Block	-
4-1	27	G-7-8-10	1/2" x 2-1/2" Socket Head Cap Screw	8
4-1	28	C-38-7-11	Control Pedestal Assembly	1
4-1	29	G-4-8-6	1/2" x 1-1/2" USS Cap Screw w/Nut & LW	2
4-1	30	B-38-8-11	Pin, Control Handle	1
4-1	31	G-48-4-8	1/4" x 2" Roll Pin	5
4-1	32	C-38-7-9A	Control Handle, Outrigger	2
4-1	33	C-38-7-9B	Control Handle, Boom	1
4-1	34	C-38-7-9C	Control Handle, Swing	1
4-1	35	C-38-7-9D	Control Handle, Bucket	1
4-1	36	C-38-7-9E	Control Handle, Crowd	1
4-1	37	A-131	Knob, Control Handle	6
4-1	38	G-55-1	Grease Fitting (1/4" Drive Type)	10
4-1	39	G-51-6-1	Pin, Yoke	6
4-1	40	A-336	Yoke	6
4-1	41	G-22-6	3/8" Nut, SAE	6
4-1	42	C-38-7-24	Control Rod	6
4-1	43	G-51-5-1	Pin, Control Rod	6
4-1	44	B-38-10-7	Seat Stop Bushing	1
4-1	45	G-13-5-2	5/16" x 1-1/2" Socket Hd. Set Screw	1
4-1	46	B-38-10-1	Seat Support Rod	1
4-1	47	B-38-10-4	Seat Swivel Bracket	1
4-1	48	G-2-8-14	1/2" x 3-1/2" Carriage Bolt w/Nut & LW	1



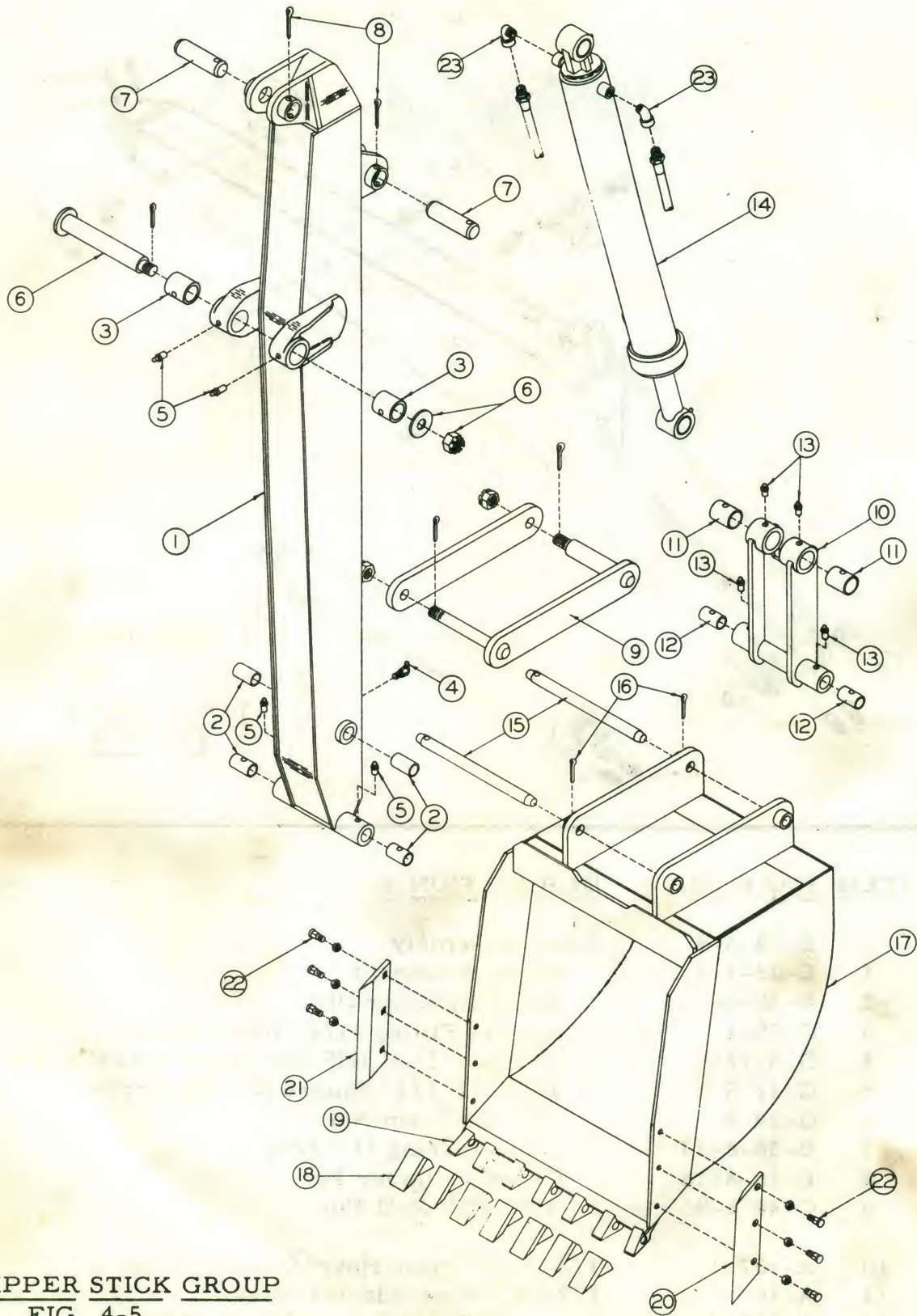
<u>FIG.</u>	<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
4-1	49	G-40-10	5/8" Flat Washer	1
4-1	50	A-423	Seat Assembly	1
4-1	51	D-38-9-1	Outrigger Tube Assembly	2
4-1	52	D-38-9-2	Outrigger Extension Assembly	2
4-1	53	B-38-8-15	Steel Bushing (1")	4
4-1	54	B-38-8-5	Outrigger Pin	2
4-1	55	G-50-4-8	1/4" x 2" Cotter Pin	2
4-1	56	B-38-8-7	Cylinder Pin, Upper	2
4-1	57	B-38-8-6	Cylinder Pin, Lower	2
4-1	58	B-50-4-16	Pin, Outrigger Adjustment	2
4-1	59	B-38-9-15	Outrigger Lug	2
4-1	60	G-4-8-8	1/2" x 2" USS Cap Screw w/Nut & LW	4
4-2	1	A-410A	Control Valve	1
4-2	2	A-202-15	"O" Ring	6
4-2	3	A-413-3	Orifice Plate, Swing Restrictor	2
4-2	4	A-358-1	7/8" - 14 SAE x 3/8" St. Hose Adaptor Union	1
4-2	5	A-358-2	7/8" - 14 SAE x 3/8" 90° Hose Adaptor Union	3
4-2	6	A-168-2	3/8" x 90° Hose Adaptor Union	4
4-2	7	A-353-36	3/8" x 36" Hose Assembly (1 Wire)	4
4-2	8	A-353-24	3/8" x 24" Hose Assembly (1 Wire)	4
4-2	9	A-358-4	7/8" - 14 SAE x 1/2" St. Hose Adaptor Union	2
4-2	10	A-351-18	1/2" x 18" Hose Assembly (1 Wire)	2
4-2	11	G-71-6-4	3/4" to 1/2" Reducer Bushing	2
4-2	12	G-73-8-6	1" to 3/4" Reducing Ell	2
4-2	13	G-65-8-8	1" x 2" Nipple	2
4-2	14	A-420	Flow Control and Cushion Valve	1
4-2	15	G-71-8-3	1" to 3/8" Reducer Bushing	2
4-2	16	G-66-3	3/8" Pipe Plug	2
4-2	17	E-3550-18TL	Swing Cylinder	2
4-2	18	E-2576-15CC	Outrigger Cylinder	2
4-3	1	A-410A	Control Valve	-
4-3	2	A-202-15	"O" Ring	6
4-3	3	A-413-1	Orifice Plate, Boom Restrictor	1
4-3	4	A-356-90	1/2" x 90" Hose Assembly (2 Wire-SAE End)	2
4-3	5	A-356-48	1/2" x 48" Hose Assembly (2 Wire-SAE End)	2
4-3	6	A-356-66	1/2" x 66" Hose Assembly (2 Wire-SAE End)	2
4-3	7	A-350-72	3/4" x 72" Pressure Hose Assembly (2 Wire)	1
4-3	8	A-348-72	3/4" x 72" Return Hose Assembly (1 Wire)	1





<u>FIG.</u>	<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
4-4	-	E-38-3-5	Boom Assembly	-
4-4	1	E-38-3-1	Boom Weldment	1
4-4	2	B-38-8-1	Boom Cylinder Pin	1
4-4	3	G-55-1	Grease Fitting (1/4" Drive Type)	2
4-4	4	G-4-12-6	3/4" x 1-1/2" USS Cap Screw w/LW & FW	1
4-4	5	G-12-8-5	1/2" x 1-1/4" Square Hd. Set Screw	2
4-4	6	G-24-8	1/2" USS Jam Nut	2
4-4	7	B-38-8-14	Steel Bushing (1-1/2")	2
4-4	8	B-36-8-18	Crowd Cylinder Pin	1
4-4	9	G-48-6-8	3/8" x 2" Roll Pin	1
4-4	10	A-167-1	1/2" x 90° Male Hose Adaptor Union	4
4-4	11	A-167	1/2" St. Hose Adaptor Union	2
4-4	12	A-167-3	1/2" St. Female Hose Adaptor Union	2
4-4	13	A-352-36	1/2" x 36" Hose Assembly (2 Wire Braid)	2
4-4	14	E-3500-37BB	Crowd Cylinder	1
4-4	15	E-4000-37BB	Boom Cylinder	1



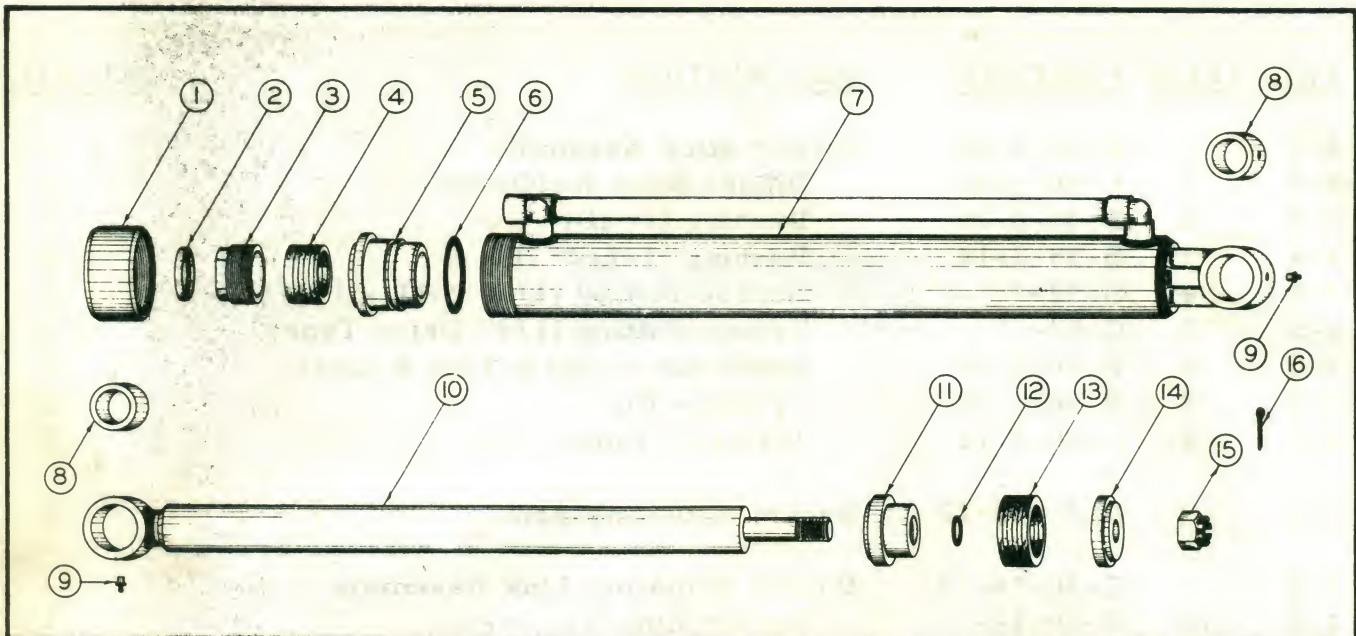


DIPPER STICK GROUP  
FIG. 4-5



<u>FIG.</u>	<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
4-5	-	E-36-4-40	Dipper Stick Assembly	-
4-5	1	E-36-4-39	Dipper Stick Weldment	1
4-5	2	B-38-8-15	Bushing (1" ID)	4
4-5	3	B-38-8-14	Bushing (1-1/2" ID)	2
4-5	4	G-52-7	Grease Fitting (1/8" NPT x 1-3/4")	1
4-5	5	G-55-1	Grease Fitting (1/4" Drive Type)	4
4-5	6	B-36-8-19	Boom Pin w/Nut & Flat Washer	1
4-5	7	B-36-8-18	Cylinder Pin	2
4-5	8	G-50-6-12	3/8" x 3" Cotter Pin	2
4-5	9	D-36-14-17	Bucket Actuating Arm	1
4-5	-	C-36-14-19	Bucket Actuating Link Assembly	-
4-5	10	C-36-14-23	Bucket Link Weldment	1
4-5	11	B-38-8-15	Bushing (1-1/2" ID)	2
4-5	12	B-38-8-14	Bushing (1" ID)	2
4-5	13	G-55-1	Grease Fitting (1/4" Drive Type)	4
4-5	14	E-3500-28BB	Bucket Cylinder	1
4-5	15	B-36-8-20	Bucket Pin	2
4-5	16	G-50-4-10	1/4" x 2-1/2" Cotter Pin	2
4-5	17	E-36-19-12	12" Bucket (Complete with Teeth & Side Cutters)	
		E-36-19-14	14" Bucket	
		E-36-19-16	16" Bucket	
		E-36-19-18	18" Bucket	
		E-36-19-20	20" Bucket	
		E-36-19-22	22" Bucket	
		E-36-19-24	24" Bucket	
		E-36-21-030	30" Bucket	
		E-36-21-032	32" Bucket	
		E-36-21-034	34" Bucket	
		E-36-21-036	36" Bucket	
		E-36-21-038	38" Bucket	
		E-36-22-12	12" Mole's Paw	
		E-36-22-16	16" Mole's Paw	
		E-36-22-20	20" Mole's Paw	
		E-36-22-24	24" Mole's Paw	
4-5	18	A-162	Bucket Tooth Point	-
4-5	19	A-163	Bucket Tooth Shank	-
4-5	20	B-36-10-55L	Bucket Bank Cutter (Left)	1
4-5	21	B-36-10-55R	Bucket Bank Cutter (Right)	1
4-5	22	G-1-6-5	3/8" x 1-1/4" Plow Bolts	6
4-5	23	G-61-4	1/2" 90° St. Ell	1

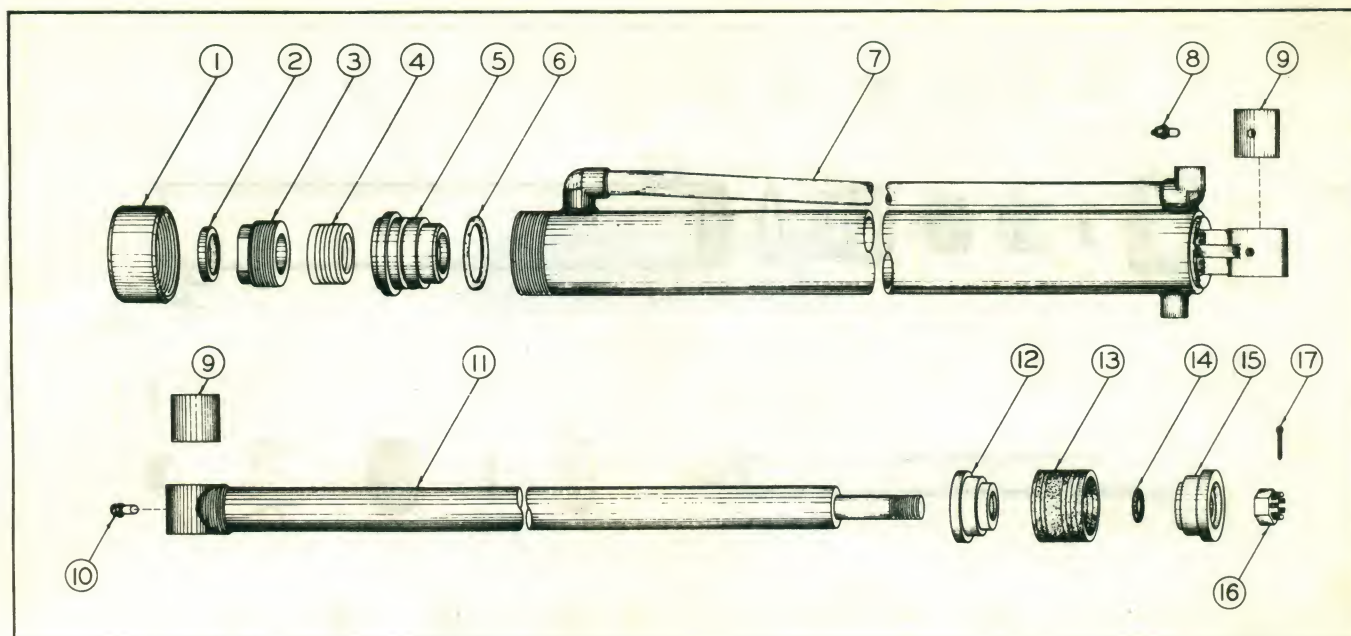




E-4000-37BB, 4" BORE BOOM CYLINDER

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
1	C-104-4	Flange Ring	1
2	A-204-3	Wiper Ring (2" ID)	1
3	B-105-4-1	Packing Gland (2" ID)	1
4	A-203-7	Packing (2" ID)	1
5	C-103-17	Cylinder Head	1
6	A-202-11	"O" Ring	1
7	D-101-7-2B	Cylinder Tube Assembly	1
8	A-105	Bronze Bushing	2
9	G-55-1	St. Grease Fitting (Drive Type)	2
10	C-102-5-1B	Piston Rod Assembly	1
11	B-110-11	Piston	1
12	A-202-2	"O" Ring (1/8" x 1-1/4" OD)	1
13	A-320-4	"V" Packing Set	1
14	B-111-10	Retainer	1
15	G-26-16	Castle Nut (1")	1
16	G-50-3-6	Cotter Pin (3/16" x 1-1/2")	1

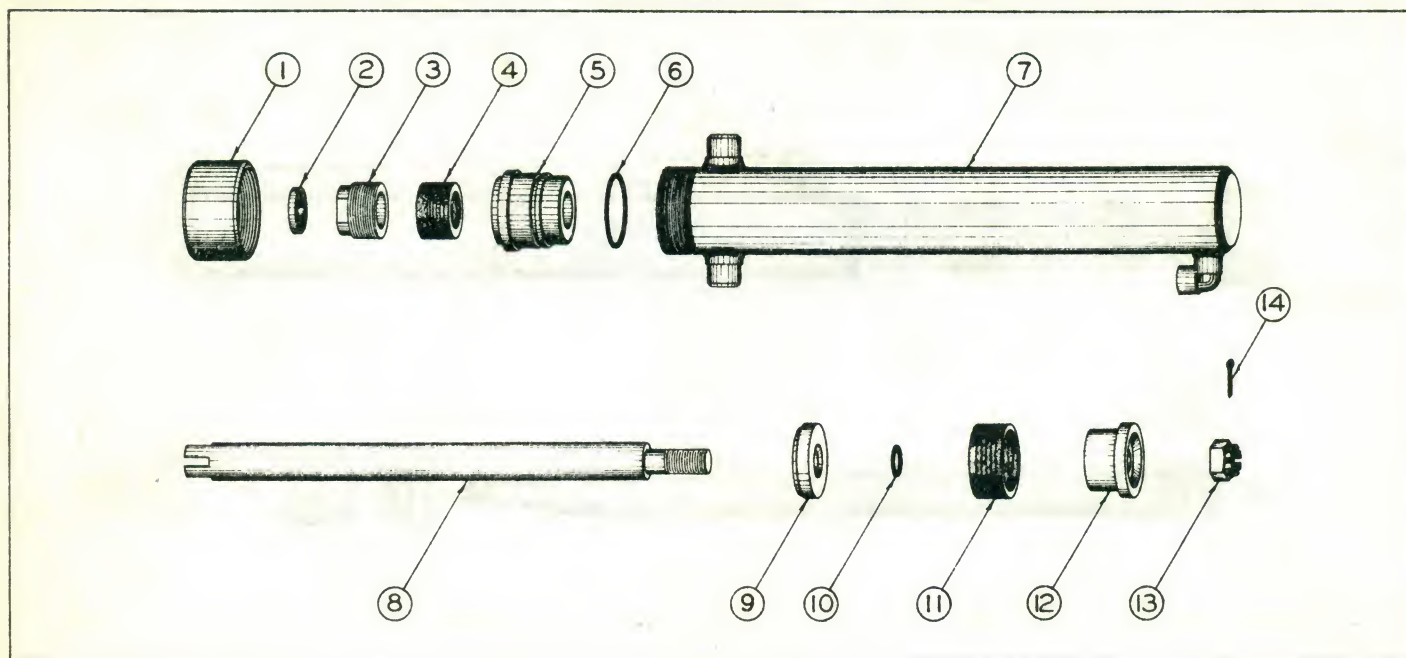




E-3500-37BB CROWD CYLINDER

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
1	C-104-1	Flange Ring	1
2	A-204-3	Wiper Ring (2" ID)	1
3	B-105-4-1	Packing Gland	1
4	A-203-7	Packing (2" ID)	1
5	C-103-12	Cylinder Head	1
6	A-202-1	"O" Ring	1
7	D-101-1-7B	Cylinder Tube Assembly	1
8	G-55-1	St. Grease Fitting (Drive Type)	1
9	A-105	Bronze Bushing	2
10	G-55-1	St. Grease Fitting (Drive Type)	1
11	C-102-5-1B	Piston Rod Assembly	1
12	B-110-13	Piston 3-1/2" (Double Acting)	1
13	A-321-3	3-1/2" "V" Packing Set	1
14	A-202-2	"O" Ring (1/8" x 1-1/4" OD)	1
15	B-110-14	Piston 3-1/2" (Double Acting)	1
16	G-26-16	Castle Nut (1")	1
17	G-50-3-6	Cotter Pin (3/16" x 1-1/2")	1

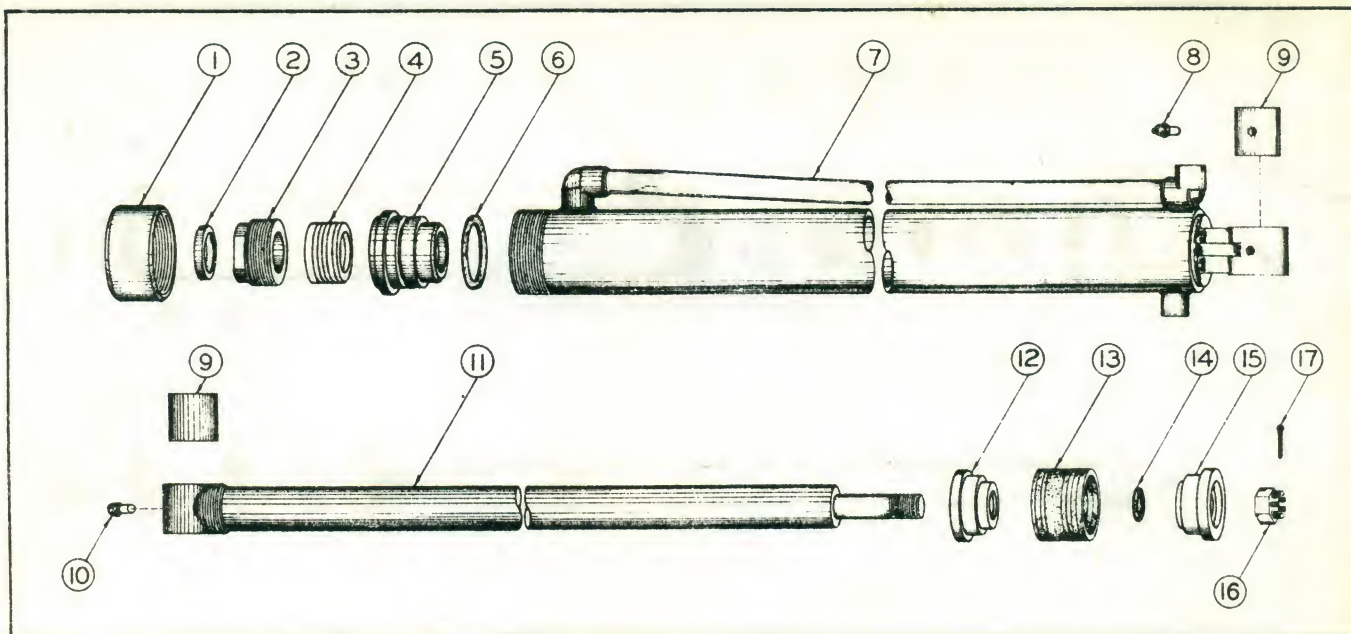




E-3550-18TL SWING CYLINDER

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
1	C-104-1	Flange Ring	1
2	A-204-1	Wiper Ring (1-1/2" ID)	1
3	B-105-2-1	Packing Gland	1
4	A-203-1	Packing (1-1/2" ID)	1
5	C-103-2	Cylinder Head	1
6	A-202-1	"O" Ring	1
7	C-101-1-15L	Cylinder Tube Assembly	1
8	C-102-2-15T	Piston Rod Assembly	1
9	B-111-11	Retainer	1
10	A-202-2	"O" Ring (1/8" x 1-1/4" OD)	1
11	A-320-3	"V" Packing Set	1
12	B-110-24	Piston	1
13	G-26-16	Castle Nut (1")	1
14	G-50-3-6	Cotter Pin (3/16" x 1-1/2")	1

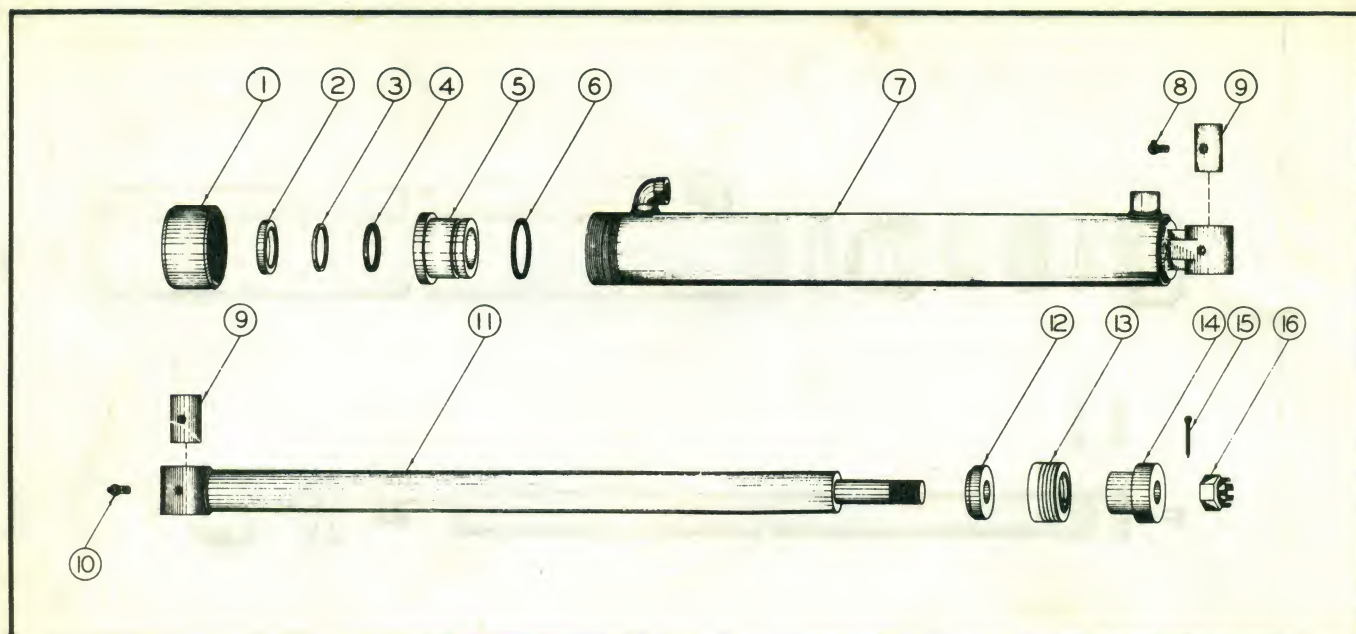




### E-3500-28BB BUCKET CYLINDER

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
1	C-104-1	Flange Ring	1
2	A-204-3	Wiper Ring (2" ID)	1
3	B-105-4-1	Packing Gland (2")	1
4	A-203-7	Packing (2" ID)	1
5	C-103-12	Cylinder Head	1
6	A-202-1	"O" Ring	1
7	D-101-1-10B	Cylinder Tube Assembly	1
8	G-55-1	St. Grease Fitting (Drive Type)	1
9	A-105	Bronze Bushing	2
10	G-55-1	St. Grease Fitting (Drive Type)	1
11	C-102-5-2B	Piston Rod Assembly	1
12	B-110-13	Piston 3-1/2" (Double Acting)	1
13	A-321-3	3-1/2" "V" Packing Set	1
14	A-202-2	"O" Ring (1/8" x 1-1/4" OD)	1
15	B-110-14	Piston 3-1/2" (Double Acting)	1
16	G-26-16	Castle Nut (1")	1
17	G-50-3-6	Cotter Pin (3/16" x 1-1/2")	1

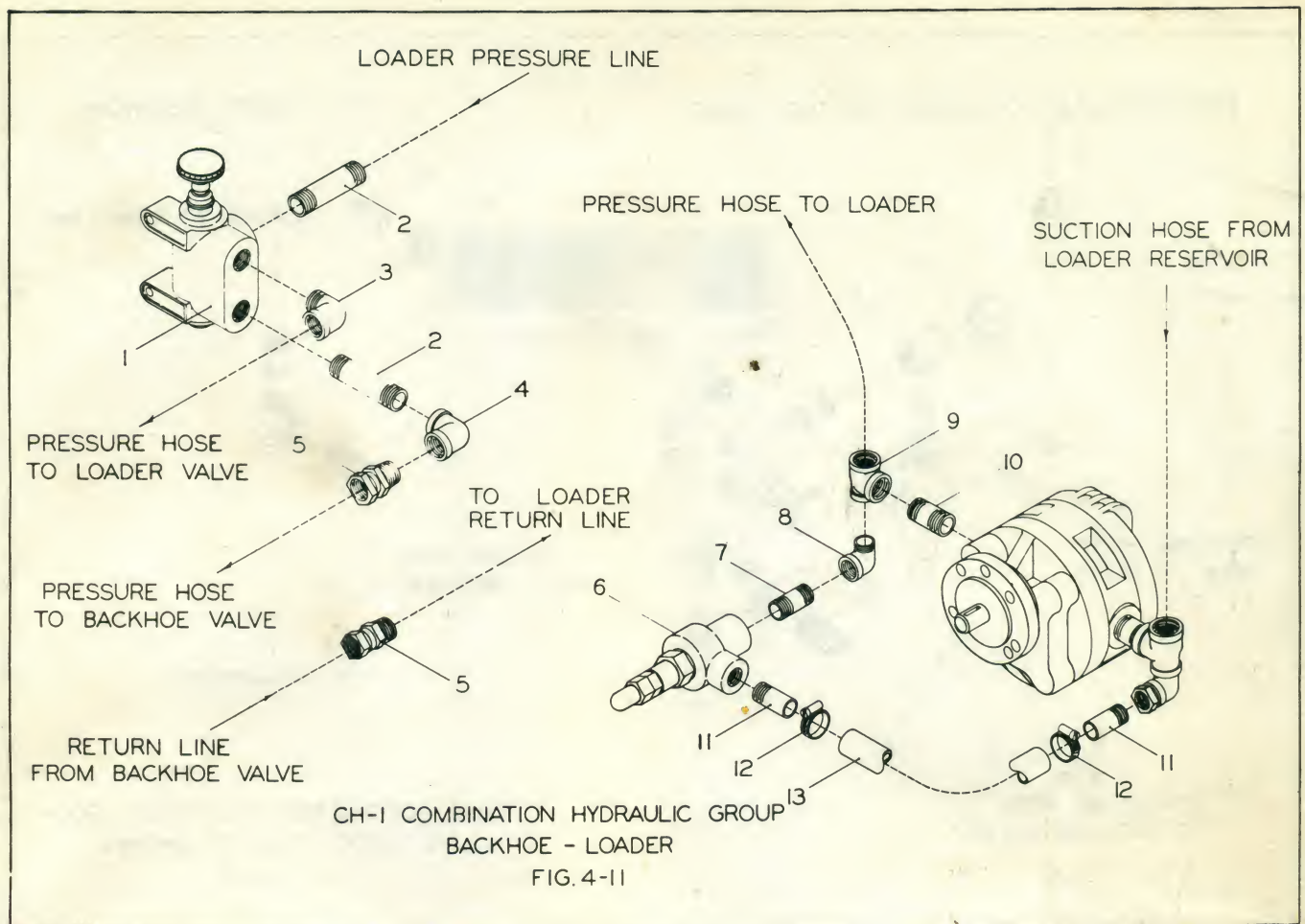




E-2576-15CC OUTRIGGER CYLINDER

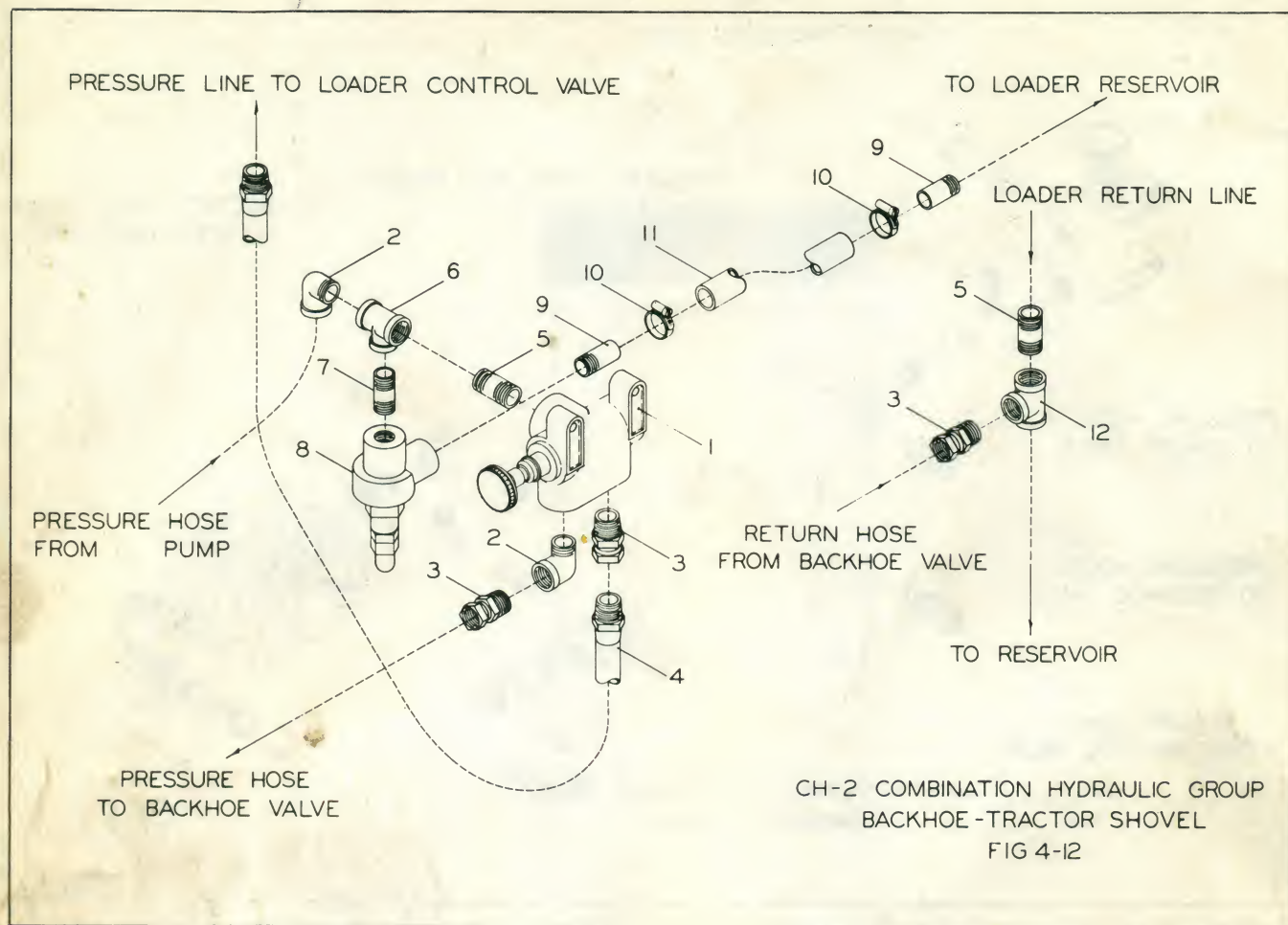
<u>ITEM NO.</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
1	B-104-2	Flange Ring	1
2	A-204-2	Wiper Ring (1-3/4" ID)	1
3	A-288-2	Back-Up Washer	1
4	A-202-8	"O" Ring (2-1/8" OD x 1/8")	1
5	B-103-5	Cylinder Head	1
6	A-202-7	"O" Ring (2-1/2" OD x 1/8")	1
7	C-101-4-2C	Outrigger Cylinder Tube	1
8	G-54-1	1/8" - 90° Grease Fitting	1
9	A-170	Bronze Bushings	2
10	G-52-1	1/8" St. Grease Fitting	1
11	C-102-1-11C	Piston Rod Assembly	1
12	B-114-2	Spacer	1
13	A-203-5	Packing (1-3/4" ID)	1
14	B-110-3	"V" Ring Piston	1
15	G-50-3-8	Cotter Pin (3/16" x 2")	1
16	G-26-16	Castle Nut (1")	1





<u>ITEM NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
1	A-314	Diversion Valve	1
2	G-65-6-12	3/4" x 3" Pipe Nipple	2
3	G-61-6	3/4" 90° St. Ell	1
4	G-62-6	3/4" 90° Ell	1
5	A-169	3/4" Hose Adaptor Union	1
6	A-301-1	Relief Valve	1
7	G-65-4-6	1/2" x 1-1/2" Pipe Nipple	1
8	G-61-4	1/2" 90° St. Ell	1
9	G-68-6x4x6	3/4" x 1/2" x 3/4" Tee	1
10	G-65-6-6	3/4" x 1-1/2" Nipple	1
11	B-35444-3	1/2" Hose Nipple	2
12	A-123	3/4" Hose Clamps	2
13	A-315-12	3/4" Hose	12"





<u>ITEM NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ.</u>
1	A-314	Diversion Valve	1
2	G-61-6	3/4" St. Ell	2
3	A-169	3/4" Hose Adaptor Union	3
4	A-350-24	3/4" x 24" Hose Assembly	1
5	G-65-6-6	3/4" x 1-1/2" Pipe Nipple	2
6	G-68-6x6x4	3/4" x 3/4" x 1/2" Pipe Tee	1
7	G-65-4-6	1/2" x 1-1/2" Pipe Nipple	1
8	A-301-1	Relief Valve	1
9	B-35444-3	1/2" Hose Nipple	2
10	A-123	Hose Clamps	2
11	A-315-5	3/4" Hose	5"
12	G-68-6	3/4" Pipe Tee	1



# CONTROL VALVE

FIG. 4-13





<u>FIG.</u>	<u>ITEM</u>	<u>PART NO.</u>	<u>NAME &amp; DESCRIPTION</u>	<u>NO. REQ.</u>
4-13	-	A-410A	Control Valve (Cessna)	-
4-13	1	A-410-1	Inlet Section	1
4-13	2	A-410-2	Outriggers, Swing & Bucket Sections	4
4-13	3	A-410-3	Boom Section	1
4-13	4	A-410-5	Crowd Section	1
4-13	5	A-410-6	End Section	1
4-13	6	A-202-20-50	"O" Ring (1-1/16" OD x 3/32")	12
4-13	7	A-410-15	Cap Assembly	6
4-13	8	A-410-16	Bushing, Body	6
4-13	9	A-410-17	Washer (1-1/16" OD)	6
4-13	10	A-410-18	Sleeve, Spool	6
4-13	11	A-410-19	Spring, Spool Centering	6
4-13	12	A-410-20	Washer (59/64" OD)	6
4-13	13	A-410-21	Snap Ring, 1/2" Sq.	6
4-13	14	A-410-22	Body, Lift Check	6
4-13	15	A-287-1	Nylon Ball, 1/2" Dia.	6
4-13	16	A-288-6	Back-Up Washer (3/32" x 15/16" OD)	18
4-13	17	A-202-19	"O" Ring (3/32" x 15/16" OD)	13
4-13	18	A-202-16	"O" Ring (1/16" x 1" OD)	7
4-13	19	A-202-17	"O" Ring (1/16" x 1-1/4" OD)	7
4-13	20	A-202-18	"O" Ring (1/16" x 1-1/2" OD)	7
4-13	21	A-417-1500	1500 PSI Cessna Relief Valve Cartridge	1
4-13	22	A-417-2000	2000 PSI Cessna Relief Valve Cartridge	1
4-13	23	A-417-3000	3000 PSI Cessna Relief Valve Cartridge	1
4-13	24	A-202-20	"O" Ring (1-1/16" OD x 3/32")	5
4-13	25	A-288-7	Back-Up Washer (3/32" x 1-1/8" OD)	5
4-13	26	A-202-21	"O" Ring (1-1/8" OD x 3/32")	5
4-13	27	A-410-9	Relief Valve, Adjustable Type (See Page 4-17)	1
4-13	28	A-410-8	Anti-Cavitation Check	1
4-13	29	A-410-10	Plug (Port Section)	1
4-13	30	A-288-8	Back-Up Washer (9/16" ID x 3/32")	1
4-13	31	A-202-22	"O" Ring (9/16" ID x 3/32")	1
4-13	32	A-410-7	Section Bolts w/LW	3
		A-410-12	"O" Ring & Seal Repair Kit for A-410-2 Section*	
		A-410-13	"O" Ring & Seal Repair Kit for A-410-3 or A-410-5 Section	*
		A-410-14	"O" Ring Repair Kit for A-410A Control Valve **	**

\* Includes all "O" Rings and Back-Up Washers for Repair of one Valve Section.

\*\* Includes all "O" Rings required between Sections of 6-Spool Valve.



DOWN PRESSURE RELIEF VALVE GROUP  
FIG. 4-14

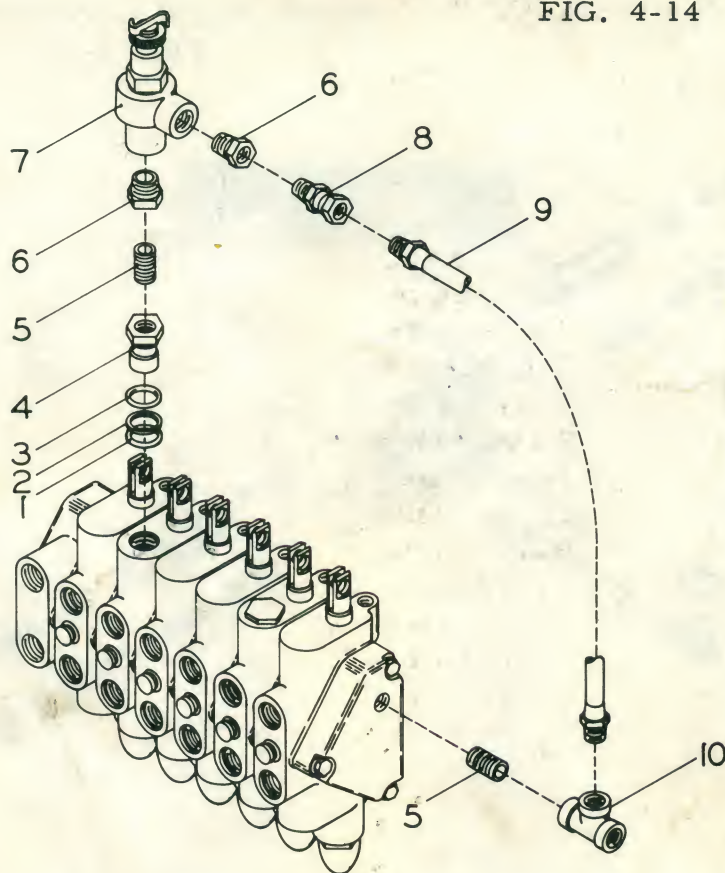


FIG.	ITEM	PART NO.	DESCRIPTION	NO. REQ.
4-14	1	A-202-21	"O" Ring (1-1/8" OD x 3/32")	1
4-14	2	A-288-7	Back-Up Washer (3/32" x 1-1/8" OD)	1
4-14	3	A-202-20	"O" Ring (1-1/16" OD x 3/32")	1
4-14	4	A-410-11	Relief Valve Adaptor	1
4-14	5	G-65-3-0	3/8" Pipe Nipple (Close)	2
4-14	6	G-71-4-3	1/2" to 3/8" Reducer Bushing	2
4-14	7	A-301	Relief Valve	1
4-14	8	A-168	3/8" St. Adaptor Union	1
4-14	9	A-353-18	3/8" x 18" Hose Assembly	1
4-14	10	G-68-3	3/8" Pipe Tee	1

NOTE: This Relief Valve Group is used on Backhoes with Serial Number 7001 thru 7500, in place of A-410-9. (Item 27, Fig. 4-13)



# SWING FLOW CONTROL VALVE

FIG. 4-15

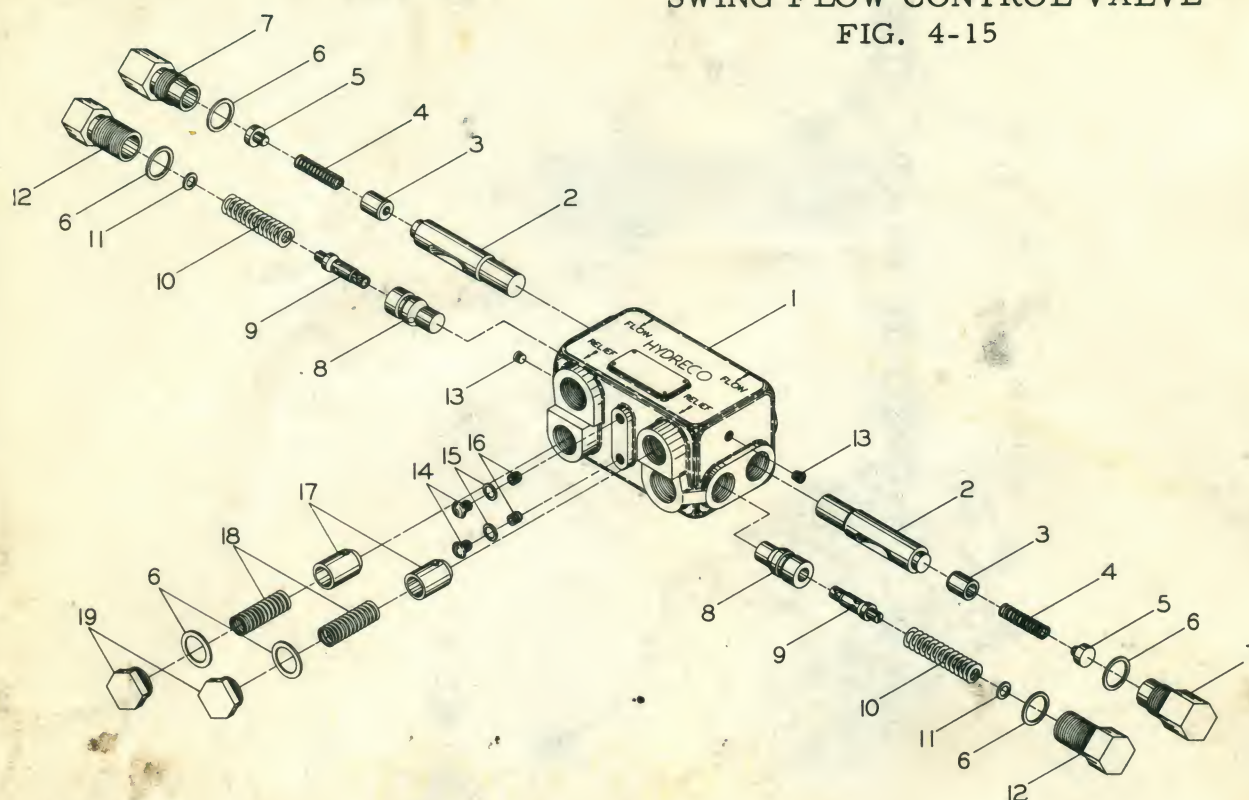


FIG.	ITEM	PART NO.	DESCRIPTION	NO. REQ.
4-15	-	A-420	Swing Flow Control Valve	-
4-15	1	A-420-1	Valve Housing	1
4-15	2	A-420-2	Plunger	2
4-15	3	A-420-3	Dash Pot Plunger	2
4-15	4	A-420-4	Flow Plunger Spring	2
4-15	5	A-420-5	Spring Guide	2
4-15	6	A-420-6	Gasket	6
4-15	7	A-420-7	Flow Control Cap	2
4-15	8	A-420-8	Relief Valve Seat	2
4-15	9	A-420-9	Relief Valve Plunger Assembly	2
4-15	10	A-420-10	Relief Valve Spring	2
4-15	11	A-420-11	Washer	-
4-15	12	A-420-12	Relief Valve Cap	2
4-15	13	A-420-13	Pipe Plug	2
4-15	14	A-420-14	Set Screw	2
4-15	15	A-420-15	Gasket	2
4-15	16	A-420-16	Machine Screw	2
4-15	17	A-420-17	Check Valve Plunger	2
4-15	18	A-420-18	Check Valve Spring	2
4-15	19	A-420-19	Check Valve Cap	2



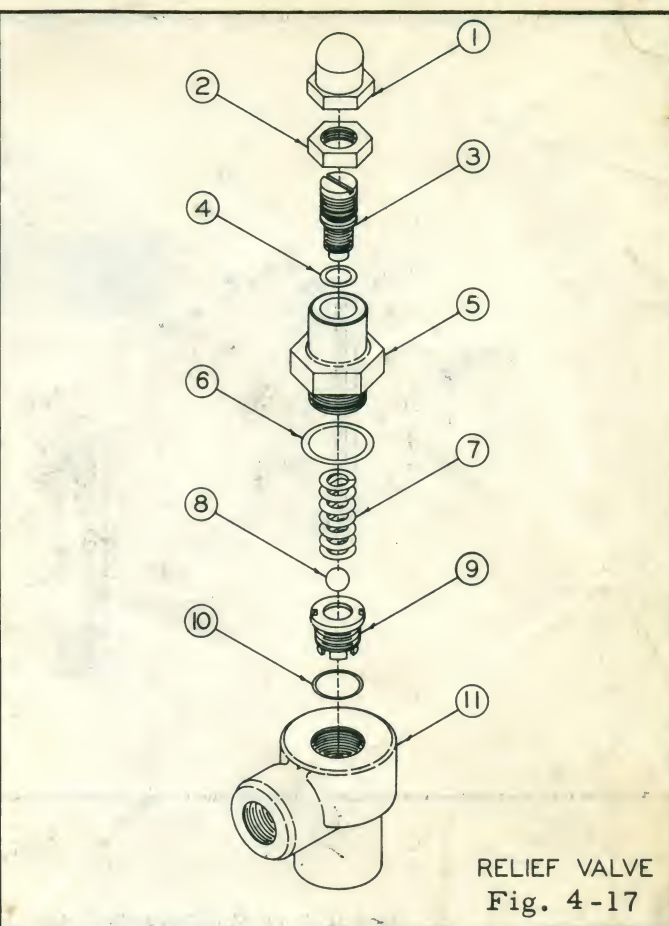
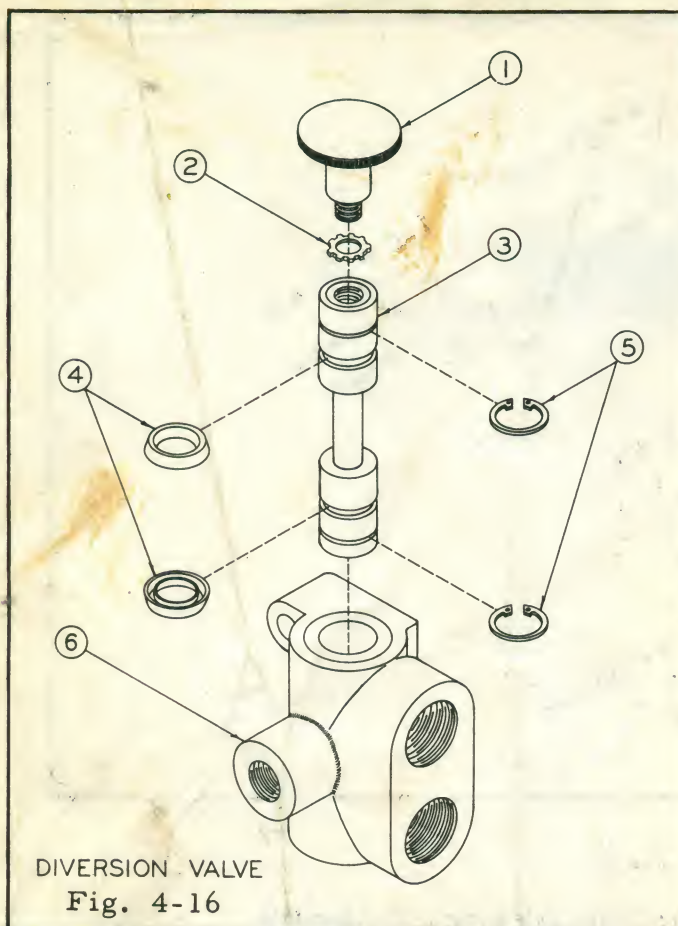


FIG.	ITEM	PART NO.	DESCRIPTION	NO. REQ.
16	1	G-081	Control Knob	1
16	2	G-603	Lock Washer	2
16	3	G-1126	Valve Spool	1
16	4	G-1129	"U" Cup Seals	2
16	5	G-1127	Snap Rings	2
16	6	G-1125	Valve Housing	1
17	1	974	Cap Nut	1
17	2	973	Jam Nut	1
17	3	925	Adjusting Screw	1
17	4	926	"O" Ring	1
17	5	924	Valve Body	1
17	6	923	Gasket	1
17	7	922	Spring	1
17	8	014	Ball	1
17	9	921	Valve Seat	1
17	10	062	"O" Ring	1
17	11	986	Valve Housing	1



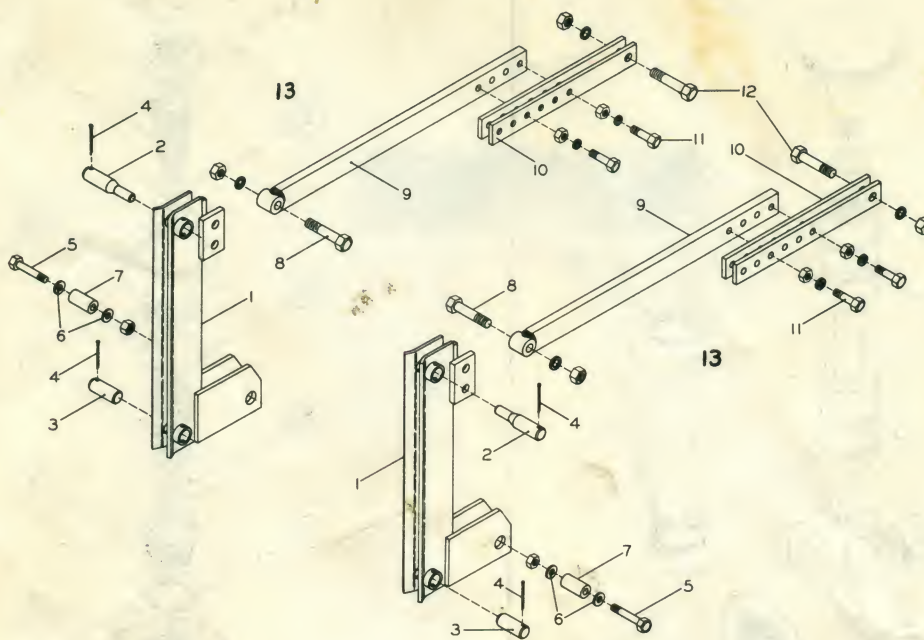


FIG. 4-18

MARK II BACKHOE MOUNTING BRACKET GROUP

FIG.	ITEM	PART NO.	DESCRIPTION	NO. REQ.		
				BL-1	BL-2	BL-3
4-18	1	C-38-20-16	Mounting Bracket	2		
4-18	1	C-38-20-17	Mounting Bracket		2	
4-18	1	C-38-20-18	Mounting Bracket			2
4-18	2	B-38-8-8	Upper Pin	2	2	2
4-18	3	B-38-8-9	Lower Pin	2	2	2
4-18	4	G-50-6-12	3/8" x 3" Cotter Pin	4	4	4
4-18	5	G-4-12-16	3/8" x 4" USS Cap Screw w/Nut	2	2	2
4-18	6	G-40-12	3/8" Flat Washer	4	4	4
4-18	7	B-38-20-6	Bushing	2	2	2
4-18	8	G-5-16-18	1" x 4-1/2" SAE Cap Screw w/Nut & LW	2	2	2
4-18	9	B-38-20-22	Brace Bar Weldment	2	2	2
4-18	10	B-38-20-24	Adjustable Link Weldment	2	2	2
4-18	11	G-4-12-12	3/4" x 3" USS Cap Screw w/Nut & LW	4	4	4
4-18	12	G-5-16-20	1" x 5" SAE Cap Screw w/Nut & LW	2	2	2
4-18	13	C-38-20-23	Brace Assembly	2	2	2





BRANCH WAREHOUSE  
710 HENRY STREET, CHARLOTTESVILLE, VA.  
PHONE 3-4714

## Hamilton Equipment, Inc.

*Wholesale Distributors*

P. O. BOX 178

Ephrata • Lancaster County • Penna.

PAID BY REPUBLIC 3-2238

ADDRESS REPLY TO—  
Ephrata, Penna.

SUBJECT: HENRY BACKHOES MARK II AND MARK III MODIFICATIONS

Gentlemen:

Attached is Henry Service Bulletin #23 concerning modifications being made on the Mark II and Mark III Backhoes in the field.

We are sending to you, under separate cover, the required number of Kits for the Backhoes you have received to date.

Note that the Mark II and Mark III Kits are not identical, in that the Mark III Kits have (3) A 417-1500 Relief Valves instead of one.

As in the case with the Henry Manufacturing Company charging us, you will be charged a similar amount for each Kit, but when the old Relief Valves are returned to us, credit will be issued to your account. To this credit will be added a \$20.00 labor allowance.

We urge you to get these modifications made as soon as possible to eliminate breakage and Relief Valve difficulties. Also, note their last paragraph that "After January 1, 1959, warranty claims concerned directly with the three points as stated herein, will not be honored on any Mark II or Mark III Backhoe that has not been so modified at the factory or in the field".

BE SURE TO SEND US THE SERIAL NUMBER OF THE BACKHOES THAT HAVE BEEN MODIFIED.

Cordially yours,

HAMILTON EQUIPMENT, INC.

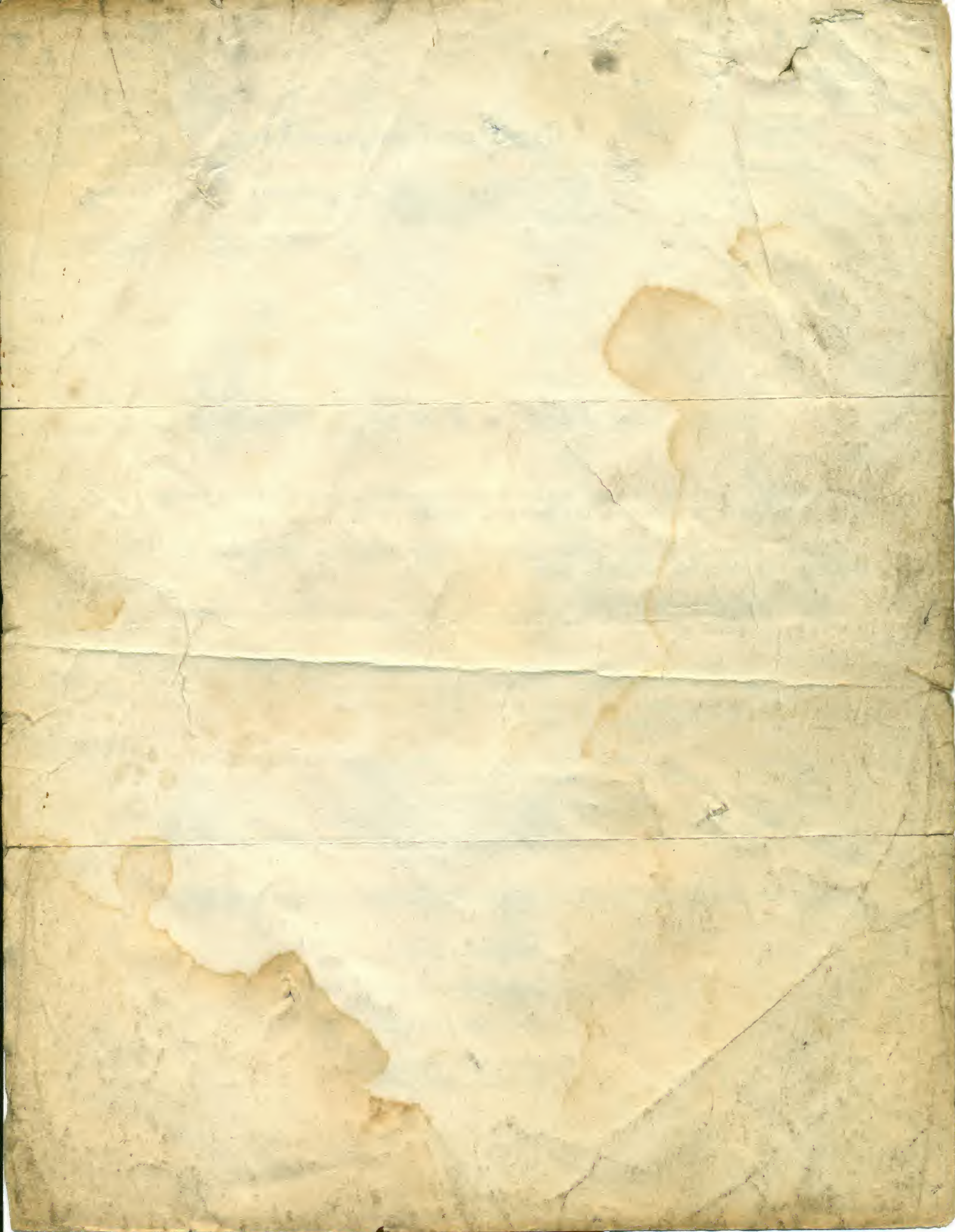
*Robert C. Rummel*

Robert C. Rummel  
Service Engineer

RCR:bm  
Enc.











BOX 521 - TOPEKA, KANSAS

# PARTS and SERVICE BULLETIN

DATE November 3, 1958 NO. 23

SUBJECT MARK II AND MARK III  
MODIFICATIONS

Three important modifications and improvements are being made on all Mark II and Mark III backhoes in current production as outlined below. Furthermore, these three improvements may be added to all Mark II and Mark III backhoes in stock and in use in order to make them equal in performance and service to current production models. The policy for making these field changes is explained in the section of this Bulletin headed "PROCEDURE FOR MARK II AND MARK III MODIFICATIONS".

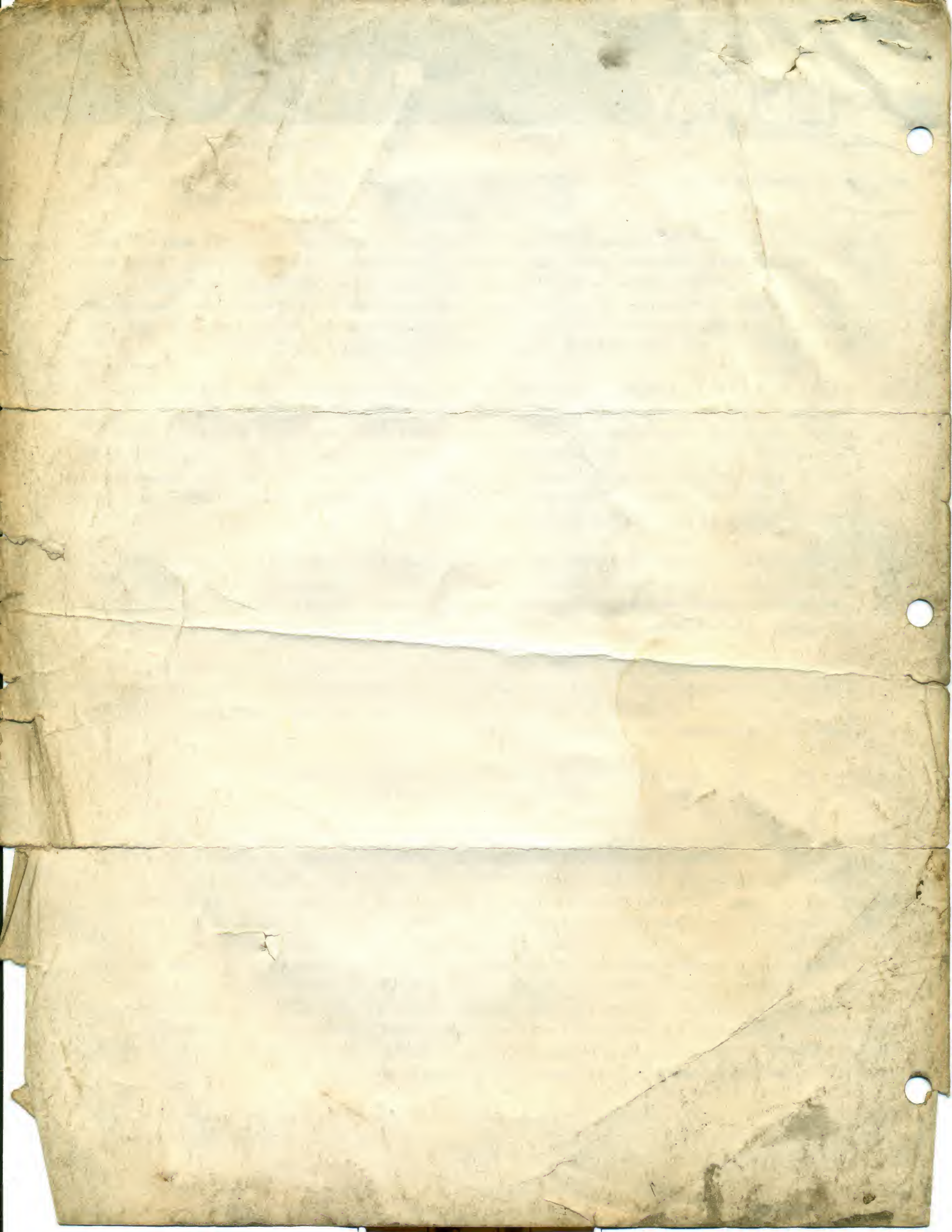
1. A-417 RELIEF VALVES. These relief valves as originally supplied to us by Cessna in the main control valves contained a nylon pilot poppet. However, under some operating conditions the nylon has become soft causing a pressure drop throughout the system. To correct this situation we are now being supplied with relief valves which use a hardened steel poppet; these will be factory installed on all Mark II and Mark III backhoes beginning with Serial #7610. The new valves are identified as illustrated in Figure 1.
2. MARK II AND MARK III BOOM MODIFICATION. To eliminate the possibility of boom failure as a result of fatigue, a lap plate is being added to all Mark II and Mark III backhoes beginning with Serial #7614. Figure 2 illustrates how the lap plate, Part #B-38-3-32, is to be welded onto the boom for field modification.
3. SWING FRAME MODIFICATION. In order to provide additional strength in the swing frame and to reduce the possibility of abrasion on hoses, Part #B-28-2-70 is being added to all Mark II and Mark III backhoes beginning with Serial #7614. Figure 3 illustrates the field modification.

## PROCEDURE FOR MARK II AND MARK III FIELD MODIFICATIONS

It is extremely important that all Mark II and Mark III backhoes in stock and in the field shall be modified through the improvements and additions as outlined. Therefore, each Henry Distributor will be supplied with a complete field modification kit for every Mark II and Mark III that has been shipped from the factory. The Distributor will be invoiced for these kits in the amount of \$40.70 for each Mark II kit, and \$68.00 for each Mark III kit. These are list prices for the relief valves only; the parts for swing frame and boom modification are being shipped "no charge". All kits will be shipped freight prepaid. When all three modifications have been performed on a machine, credit will be issued for the amount of the kit plus \$20.00 labor allowance. However, credit will not be issued until the old relief valves are returned with a Return Parts Form giving the serial number of the backhoe modified and a statement that all three modifications have been performed.

After January 1, 1959, warranty claims concerned directly with the three points as stated herein, will not be honored on any Mark II or Mark III backhoe that has not been so modified at the factory or in the field.







MARK II AND MARK III  
FIELD MODIFICATION KITS

Each of these kits consists of the following parts;

For Mark II Backhoes

3 - A417 Relief Valves ( 1 - A417-1500,  
1 - A417-2000,  
1 - A417-3000)

1 - B-38-3-32 Lap Plate

1 - B-38-2-70 Swing Frame Insert

For Mark III Backhoes

5 - A417 Relief Valves ( 3 - A417-1500,  
1 - A417-2000,  
1 - A417-3000)

1 - B-38-3-32 Lap Plate

1 - B-38-2-70 Swing Frame Insert

Figure 1 illustrates the markings on the new relief valves.  
Valves with any other markings are to be replaced.

Figure 2 illustrates the field installation of the #B-38-3-32  
Lap Plate.

Figure 3 illustrates the field installation of the #B-38-2-70  
Swing Frame Insert.

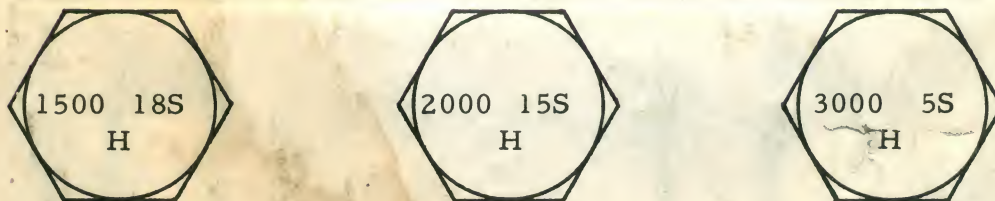


Figure 1

**HENRY MANUFACTURING  
COMPANY, INC.**  
P.O. BOX 521  
TOPEKA - KANSAS

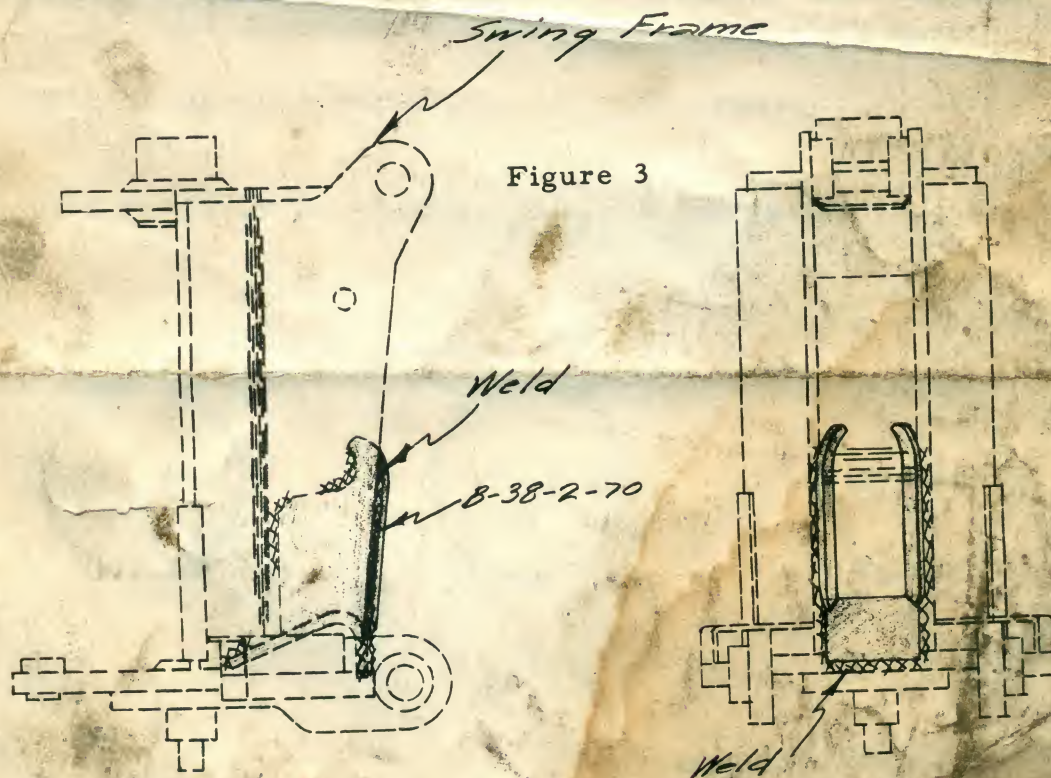
Form FMK  
Page 1



Weld Plate  
To Bottom Of Boom

B-38-3-32

Figure 2



INSERT MODIFICATION UNIT IN  
SWING FRAME AND WELD SECURELY  
TO BOTTOM PLATE AND SIDE PLATES



